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DISCUSSIONS IN EDUCATION

BY

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Late President Massachusetts Institute of Technology

AUTHOR OF "POLITICAL ECONOMY," "THE WAGES QUESTION," "MONEY," ETC.

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EDITOR'S PREFACE.

The collection into a volume of the following addresses and papers relating to education is in accordance with the expressed intention of the late President Walker. That the work should be done by an editor instead of by the author is but another of the countless losses suffered through his untimely death.

Although, while at Yale University, he had rendered admirable service to the schools both of the State of Connecticut and of the city of New Haven, the fact that no paper dealing with the subject appeared earlier than 1884, when General Walker was in middle life, indicates that questions of education had not engaged his attention, to the point of a formal discussion of them, until after he assumed the Presidency of the Massachusetts Institute of Technology, in 1881. Indeed, so much deeper had been his study of other social questions, that, while exhibiting the deepest interest in matters relating to education, he disclaimed any special or technical knowledge concerning them. That, however, he was an educator in the highest and best sense of this much-abused term is amply shown by his brilliant and altogether satisfactory administration, during the last fifteen years of his life, of the Institute of Technology, and by his admirable treatment of the special topics in education with which this volume deals.

Bred in one of what he himself calls the "old-fash-

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ioned" college courses, a teacher, in youth, of Latin and Greek, he found himself, nevertheless, in full sympathy with that newer scheme of higher education in which the pure and applied sciences take an equal position, as agents of culture, with that accorded for so many centuries to the Classics alone. An ardent, effective, and yet restrained champion of this more modern university training, he was, no less, an advocate of needed reforms in elementary and secondary teaching, doing notable work, to use Dr. Harris's apt phrase, in the "pathology of education."

The papers, arranged in such sequence as was possible, fall into four main groups: Technological Education; Manual Education; the Teaching of Arithmetic; and various College Problems. The Valedictory which, fortunately preserved, closes the volume carries its own reason for insertion.

With such omissions as are indicated and with such minor alterations as, it is believed, the author would himself have made, the papers appear as originally printed or delivered. Parts of other addresses which, because of repetition, could not be presented in full have been inserted as footnotes. It is hoped that, by this means, nothing of permanent value relating to education uttered and preserved by President Walker has failed of inclusion.

The thanks of the editor are due to the several publishers and officers of associations for their courteous permission to reprint many of the papers.

BOSTON, *September*, 1898.

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TECHNOLOGICAL EDUCATION

IMMEDIATE PROBLEMS IN TECHNOLOGICAL EDUCATION

1893

Opening Address as Chairman of the Department of Technological Instruction at the International Congress of Education, July 26, 1893. From the Addresses and Proceedings of the International Congress of Education, Chicago, 1893.

The questions in relation to technological education suggested as of pressing importance in this address are, in the main, dealt with at greater length in subsequent papers.

DISCUSSIONS IN EDUCATION

IMMEDIATE PROBLEMS IN TECHNOLOGICAL EDUCATION.

This, so far as I am aware, is the first general conference ever called to discuss the whole subject of technological education. Delegates from the "Colleges of Agriculture and the Mechanic Arts" established in the United States under the act of 1862 have for some years met in annual convention to consider matters of common interest; but in these conventions agriculture has been so far the predominant topic as to throw other departments of instruction into the shade.

It was well that this present conference should be called. It was high time that the friends of technological education should assemble, to compare their experiences, to inquire what is lacking or what has been ill done in the remarkable development that has taken place during the last twenty-five years, and to take counsel together regarding the means for completing, for perfecting, for strengthening this system of public instruction. The representatives of the classical culture long ago recognized the importance of mutual conference, and many and earnest have been the deliberations and debates in which delegates from colleges and universi-

ties have sought to find out the way by which they might do greater good to the community and to the world, in their devoted and self-sacrificing exertions on behalf of education. Technological instruction, from its newness, from the sporadic character of the enterprises with which it has been connected, from the inherent gravity and complexity of its problems, has even greater need of consultation and conference among its teachers and its friends.

It is said that nearly or quite one hundred institutions, in America alone, are now offering instruction in the applications of the sciences to the useful arts. In Great Britain, if my information is correct, the number of science schools and technical colleges is not much smaller. With but a few exceptions, this vast body of educational agencies represents the developments of only a quarter of a century. Some of these schools have been founded under the protection and patronage of great universities; others have been the outcome of independent effort. Some have sought to cover the whole ground of technological instruction; others have confined themselves to comparatively limited fields. Some have from the first achieved a decided success; others are still struggling with poverty of means, with embarrassments due perhaps to a false start, or with the inherent difficulties of their respective problems. Surely, in such a situation, it is eminently wise that the representatives of technological education should assemble in general convention, to deliberate upon the means of

advancing their common object; to inquire what restrictions, if any, should be placed around the field of their activity; to learn, each from others, what measures may be taken to promote the efficiency with which these schools shall prepare their pupils for the severe trials of professional practice; and, last of all and most of all, to search deeply into the question how technical instruction and training may be made truly educational, in the largest and best sense of that word, so that the schools shall render the greatest possible service, not merely to industry and the arts, but also to character and citizenship, to mind and manhood.

So strongly has the importance of this subject, in view of the recent very remarkable extension of the class of schools referred to, pressed upon those who have framed the plans for this general conference of education, that it has been decided to allot three morning sessions to the subject of technological education. Of these, the first, the present session, has been assigned to the discussion of the question: how far the technological instruction of to-day answers its primary requirement, the preparation of young men to enter upon the practice of the scientific professions; what failures or deficiencies have been discovered as the result of an experience wide if not long; what are the causes of any failures or deficiencies which may be found to exist; and what measures should be taken to complete and perfect these schools upon their purely professional side. The two remaining sessions are to be devoted to the consideration of the actual and

the possible work of technical schools as instruments of general education. For the purposes of the proposed discussion regarding technical education, the present occasion is most felicitous, not merely in the presence of so large a number of distinguished educators, attracted hither by the wonders and the glories of the Columbian Exposition; not merely in the inspiration afforded by this great object-lesson of industrial art, the greatest which has ever been devised by the ingenuity of man, ordered and arranged by his taste and skill, and executed by his enterprise and energy; but also, and perhaps even most of all, by the presence here, in the courts of the department of liberal arts, of the large and comprehensive exhibits made by the technical schools of our own and foreign lands. All that may be said here must be taken in connection with the work of students, the schemes of courses, the apparatus of instruction, shown in the galleries of the main building of the Exposition. Whether in their professional or their educational aspects, these exhibits should be deeply and carefully studied by every educator who would form an intelligent and candid opinion as to what the schools of this class are really doing.

In the preparation of the programme for these sessions, it has not been sought to secure a series of elaborate and exhaustive papers which should occupy the time available for the consideration of the topics proposed. It has been the wish of the management that the papers read should be comparatively brief theses, presenting

the several topics in a suggestive rather than in a comprehensive manner, with a view to invite oral discussion and to promote the face-to-face comparison of individual views and experiences.

In such a conference as this, the most that is to be expected of the presiding officer is to arrange and provide from day to day for the presence and the participation of the largest number of those whose positions and services in the cause of education, technical or general, qualify them to add to the interest and to the value of the discussion. Yet, in this first conference on the subject of technological education, I cannot forbear to avail myself of my privilege as chairman to mention certain questions which press for consideration in connection with this department of instruction.

First: How far those who control and conduct schools of technology are bound to qualify and modify their courses of instruction with reference to the fact that their students are, as a rule, not the graduates of colleges, and that the training received in these schools, therefore, must be the only training, within the college grade both as to age and as to mental development, which these students are to enjoy before entering upon the serious duties of life. This fact was clearly not in contemplation by those who first founded our schools of technology, if, indeed, it is not in flat contradiction of what they then anticipated. It seems plain from Mr. Abbott Lawrence's deed of gift to Harvard College, for the endowment of the scientific school which bears his

name, that it was his expectation that the students would be largely college graduates; yet, in the latest catalogue of that school which I have seen, among one hundred and eighty-one students only two are graduates of colleges, only one a graduate of a classical college. At the Massachusetts Institute of Technology the number of college graduates ranges between forty and fifty. These students, therefore, form only between four and five per cent. of the total membership of the school. A slightly larger proportion, I believe, is maintained at the Sheffield School at New Haven. In view of this development of schools of technology, we are bound to inquire whether their curriculum should not be more or less qualified and modified to meet the fact that their pupils are to receive no further and no other college training.

The second question I would venture to suggest is: how far the judgment of practitioners of technical professions should conclude or should influence that of the teachers and administrators of technical schools. Probably the first thought in any man's mind would be to the effect that the best advice in regard to technical education would come from those engaged in the practice of the corresponding scientific professions. Yet it appears to me that this is a subject which should be carefully discussed, and that the first thought on the presentation of the question is not as a matter of course correct.

Let us make the issue a little more specific. Engi-

neering education, for example—is it primarily and principally an engineering or an educational problem? Is the engineer who is not and has never been a teacher necessarily a better judge than a teacher who has never been an engineer? Of course it is not intended here to intimate that the opinions of practicing engineers regarding engineering education may not be of great value; that, in any case, they are not evidence which should be carefully considered by those who are to judge of any question which concerns engineering education. But who is to be *the judge*—the engineer or the educator? Whatever the professional standing of any engineer, are his views conclusive upon the faculty of an engineering school?

My own opinion is that engineering education is primarily and principally an educational and not an engineering problem; and that the judgment of a strong and experienced teacher who has studied this problem is more likely to be right than that of any engineer without experience as a teacher, however eminent he may be in his profession.

A third question of importance in the development of technical education is whether or not a substantial connection with a university constitutes an advantage. Much might be said on both sides of this question. Admirable examples are offered us of technical schools under the protection and patronage of great universities, and of detached technical schools which have steadily and successfully pursued their way, alike with-

out hindrance and without help from a corporation or a faculty having other interests as well as their own in charge. Without undertaking to discuss this question in full, I will venture to make two remarks which it seems to me should be considered at the very outset of such a discussion.

No advantage which a technical school can derive from association with a university, through the ability, experience, and comprehensive views of the corporation of such a body, will compensate for any lack of moral and intellectual sympathy with the purposes of technical education, any lack of respect for the studies and exercises of the technical school. Unless the members of the corporation of a university thoroughly believe in technical education, unless they are devoted to its objects, unless they entertain a hearty and unaffected respect for the kind of man who is to teach and the kind of man who is to receive the teaching, a technical school will derive only damage from such an association. Again, no advantage which the students of a technical school might conceivably derive from the large and varied endowment and equipment of a great university, and from companionship with bodies of students in other pursuits than their own, will compensate for the loss of scholarly impulse and the injury to self-respect which will inevitably be sustained, unless the general spirit of the university be high, manly, and devoid of snobbishness. If the technical students, through association with a university, are to come habitually in contact with

young men who have not seriously taken up the work of their lives, who regard college merely as a place in which to have a good time or to indulge in sport or dissipation, who have no settled purpose and no manly aims, and especially if the technical students are to come habitually in contact with young men who regard labor as degrading, who look upon the rough clothes and the stained fingers of the laboratory and the workshop as badges of inferiority in character or in social standing, then a technical school will derive harm, and only harm, from such an association.

A fourth question which needs to be very carefully considered by all friends of technological education is how far immediate professional success is to be weighed against ultimate professional success. It is, of course, an immense advantage to the pupils of technical schools, and to their parents and friends, that the young graduate should be able at once to earn his livelihood, even if it be an humble one. In this day, when social necessities are so grinding, and when it is so hard to start a son in life, that advantage is not to be despised or neglected. Yet there is always a wide field of choice open to those who control technical schools as to the degree in which they will offer to their pupils studies and exercises the value of which will be most fully realized in the first few years after graduation, or studies and exercises whose value will be increasingly felt through the whole course of their professional career, and which will qualify them, in larger and ever larger measure, for

positions of responsibility and trust with advancing years. It would be strange, indeed, if in the infancy of technological education many mistakes had not been made in this matter, predominantly on the side of assigning too much value to studies and exercises of immediate utility. I cannot but believe that with larger experience, and with more of conference among those who administer technological education, there will be a decided movement in the direction of subordinating the acquisition of the knacks of a trade and mere technical devices to the study of principles; and that, even in the applications of principles, valuable and invaluable as these are, reference will be had rather to their effect in giving a greater mastery of the principles themselves, than to their immediate utility in professional practice. Nay, more, I confidently believe that, even in the study of scientific principles, a continually increasing regard will be paid to their influence in expanding the mind, enlarging the views, elevating the aims, and strengthening the character of the pupil.

A fifth question presenting itself to those administering technological education is in regard to the expediency of introducing some so-called liberal studies into all technical courses. I have already adverted to the fact that the great majority of students of technology are not graduates of colleges. But aside from this, and even although all such students were college graduates, it would still fairly be a question whether some degree of philosophical study, especially in history and political

economy, should not mingle day by day with the scientific studies and exercises which form the primary subjects of instruction and training in a technical school. For myself, I am much disposed to believe that that technical school will best discharge its duty to its pupils and to the state which gives to its students, in addition to those studies and exercises which will make them exact and strong, some measure, also, of those studies and exercises which will tend to make them, at the same time, broad and fine.

The last question which I would suggest has regard to the desirability and feasibility of securing uniform requirements for admission to schools of technology. The classical colleges within New England, and perhaps over a wider region, have long been working toward the end of common rules and conditions as to entrance; and their efforts have met with a high degree of success, not only in a loyal support, by all the colleges, of the scheme of examinations adopted, but also in the manifest and marked improvement of the preparatory schools most largely contributing to their membership. It is fairly a question whether the time has not come for associated action in the same direction by the schools of technology.

I will protract these remarks only by referring to a single subject, and that is the spirit in which it behooves the representatives of technological education to meet and to answer the accusation of certain critics that the technical applications of science are incompatible with

that *disinterestedness* which it is said, and truly said, is essential to the highest results in education. Those who indulge in flings regarding the lack of disinterestedness in technological education are generally the persons who have withstood at every step the introduction of chemistry, physics, and natural history as substitutes for the older studies of the college curriculum. Beaten at all points in their futile opposition to the spirit of the times, and overwhelmed by the abundant testimony offered as to the effects of science-study in making young men as modest, loyal, fine, and pure as the best products of the classical culture, and withal more exact, resolute, and strong, these gentlemen are making their last stand against the movement of the age by denouncing the technical applications of science as interested and mercenary, and therefore as unsuited to be the means of promoting true scholarship. They are compelled to admit that the pursuit of technology is useful to the community in a degree which makes it not less than absolutely necessary for hundreds and thousands of young men to be trained in science and in the applications of science to the useful arts; but they are unwilling that these young men should be considered as scholars in the same sense and of the same degree of merit as graduates of schools whose studies and exercises are not subject to the imputation of being of any direct or immediate use. It would please those gentlemen more if, while the college graduate receives his scholarship medal of pure gold, the graduate of the school of technology should

have his testimonial stamped upon a circlet of some baser metal.

Now, it seems to me, we are bound to resent and to repel this imputation, without terms and without ceremony. We assert that the disinterestedness of study does not depend upon the immediate usefulness or uselessness of the subject-matter, but upon the spirit with which the student takes up and pursues his work. If there be zeal in investigation, if there be delight in discovery, if there be fidelity to the truth as it is discerned, nothing more can be asked by the educator of highest aims. A young man who is earnestly laboring to prepare himself for an honorable and beneficent career in life may be disinterested in every sense in which that term can be used with approbation. Our critics have been driven to a pretty pass, indeed, when the only ground upon which they can make a stand is the practical usefulness of technical studies. These gentlemen appear to have the same unnecessary fear of fruit which Macaulay, in one of his famous essays,[1] attributes, probably with some exaggeration, as his custom was, to the old philosophers. Their concern is needless. So long as the students of technology bear themselves with the same earnestness and scholarly devotion which has characterized them as a body since this system of instruction was inaugurated, the cause of education will suffer no harm. There is a wonderful virtue in science to make and to keep its disciples truthful and faithful; and at no

[1] On *Lord Bacon.*—Ed.

distant time it will be fully recognized by all teachers that the technical applications of science directly add to the value of science-study by giving a more direct object to effort, and by heightening the pleasure which the pupil feels at each step of his scholarly progress.

THE RISE AND IMPORTANCE OF APPLIED SCIENCE IN AMERICAN EDUCATION

1891

Address at the Convocation of the University of the State of New York, Albany, July 9, 1891.

Published in the *Technology Quarterly*, December, 1891, under the title "The Place of Scientific and Technical Schools in American Education."

THE RISE AND IMPORTANCE OF APPLIED SCIENCE IN AMERICAN EDUCATION.

Among the vast changes in the spirit and life of our country, in the arts, the industries, the ideas, the aspirations, of the American people, which were brought about by, or which coincided with, the great struggle from 1861 to 1865, none is more remarkable than the rapid development of schools of applied science and technology. It is no part of my duty to name even the most important of these, or to attempt to divide among them the honor of what they have, as a whole, achieved. I shall confine myself to accounting, as far as I may, for the rapidity with which these schools have spread over the land, and to estimating their place in our educational system.

The nearest and easiest thing to say regarding the growth of scientific and technical schools, since the fortunate conclusion of the Civil War, is that the industrial development of the country had reached the point where it had become necessary that the enterprises into which our labor and capital were to be put should be organized and directed with much more of skill and scientific knowledge than had been applied to our earlier efforts at manufactures and transportation; and so in the fullness of time, scientific and technical schools came. In

this view there is much truth. The vaster enterprises of these later days, the ever increasing possibilities of modern commerce and industry, the intensifying severity of competition due to quickened communication, fast mails, cheap freights, and ocean cables, had indeed created an urgent want for greater technical skill and for more highly trained intelligence. The old wasteful ways of dealing with materials, the rule-of-thumb methods of construction, the haphazard administration, characteristic of our earlier industrial efforts, could not have been continued without greatly retarding the national development and without irreparable loss in the result. But, at the time spoken of, this want had not become one of which our people were generally conscious; much less had it created a demand for such institutions sufficient of itself to bring them into existence. The establishment of scientific and technical schools in the United States was to constitute a striking instance of the principle that, in some things, supply must create demand.

[After development of this principle upon lines similar to those followed in the address on *Technological and Technical Education* (see p. 96) the address proceeds.]

But no one who thoroughly believes in the mission of schools of this class can be content merely to assert that the full time had come in the economic evolution of the nation when such schools were imperatively needed for the promotion of our industries, and that the institutions thus called into being have done this, their primary

work, with triumphant success. We go far beyond this, and assert for these schools that they have come to form a most important part of the proper educational system of the country, and that they are to-day doing a work in the intellectual development of our people which is not surpassed, if indeed it be equaled, by that of the classical colleges. No statement less broad and strong than this would begin to do justice to the view we take of what these schools are now doing, and are in an increasing measure to do, for the manhood and citizenship of the country. We believe that in the schools of applied science and technology as they are carried on to-day in the United States, involving the thorough and most scholarly study of principles directed immediately upon useful arts, and rising, in their higher grades, into original investigation and research, is to be found almost the perfection of education for young men. Too long have we submitted to be considered as furnishing something which is, indeed, more immediately and practically useful than a so-called liberal education, but which is, after all, less noble and fine. Too long have our schools of applied science and technology been popularly regarded as affording an inferior substitute for classical colleges to those who could not afford to go to college, then take a course in a medical or law school, and then wait for professional practice. Too long have the graduates of such schools been spoken of as though they had acquired the arts of livelihood at some sacrifice of mental development, intellectual culture, and grace of life.

For me, if I did not believe that the graduates of the institution over which I have the honor to preside were as well educated men, in all which the term "educated man" implies, as the average graduate of the ordinary college, I would not consent to hold my position for another day. It is true that something of form and style may be sacrificed in the earnest, direct, and laborious endeavors of the student of science; but that all the essentials of intellect and character are one whit less fully or less happily achieved through such a course of study, let no man connected with such an institution for a moment concede!

That mind and manhood alike are served in a pre-eminent degree by the systematic study of chemistry, physics, and natural history, has passed beyond dispute. The haste with which the colleges themselves are throwing over many of their traditional subjects to make room for these comparatively new studies, shows how general has become the appreciation of the virtue of these, when combined with laboratory methods, as means of intellectual and moral training.

I have spoken of the characteristic studies of these schools as the best of all available means of both moral and intellectual training. I believe this claim to be none too broad.

First, the sincerity of purpose and the intellectual honesty which are bred in the laboratory of chemistry and physics stand in strong contrast with the dangerous tendencies to plausibility, sophistry, casuistry, and self-

delusion which so insidiously beset the pursuit of metaphysics, dialectics, and rhetoric, according to the traditions of the schools. Much of the training given in college in my boyhood was, it is not too much to say, directed straight upon the arts which go to make the worse appear the better reason. It was always an added feather in the cap of the young disputant that he had won a debate in a cause in which he did not believe. Surely, in these more enlightened days, it is not needful to say that this is perilous practice, if, indeed, it is not always and necessarily pernicious. Even where the element of purposed and boasted self-stultification was absent, there was a dangerous and mischievous exaltation of the form above the substance of the student's work, which made it better to be brilliant than to be sound.

Contrast with this the moral and intellectual influence of the studies and exercises we are considering. The student of chemistry or physics would scarcely know how to defend a thesis which he did not himself believe. In that dangerous art he has had no practice. The only success he has hoped for has been to be right. The only failure he has had to fear was to be wrong. To be brilliant in error only heightened the failure, making it the more conspicuous and ludicrous. How wholesome to the mind and heart of the pupil is such a regimen!

Again, in addition to the graces of sincerity and intellectual honesty, which are the proper traits of physical and natural science, there is great virtue, as training for

practical work in life, of whatever kind, in whatever sphere, in that objective study of concrete things which so largely makes up the curriculum of the schools we are considering.

Still another advantage which we claim for the characteristic studies of the new schools is that, in a very large degree, they dispense with the system of examinations which has become the curse of modern education. The recent remarkable outburst in England, from educators of every name and class, against that system, justifies the strong terms I have used. It is admitted on all sides to be a problem of the greatest difficulty so to adjust their scheme that examinations shall not largely neutralize the good effects of sincere and straightforward study.

So far has cramming been carried in English universities, and even in our own colleges, that examinations have largely ceased to test the scholar's attainments, much less his real proficiency in his studies. Students who have a marked facility in this sort of thing acquire, in time, the faculty of passing creditable examinations upon matters of which they know almost absolutely nothing. By steadily cramming for a few days and nights, under artful coaches, who know the professors' weaknesses and fads, a young man exceptionally expert can "get up" a subject,[1] of which he would be troubled,

[1] I would not disparage the importance, as a professional accomplishment, of the ability to "get up" a subject in a very short time under high pressure. A lawyer has often occasion to do this very thing. But this is a professional accomplishment, and should be

the morning after examination, to give an intelligible account. There develops a special organ—the examination organ—which is as specific as the water-sacks attached to the stomach of a camel and intended only to carry a certain amount of refreshment over a very dry place for a very short time. Indeed, the comparison fails to do justice to its subject. The examination organ is at once as specific and as external as the pouch of a kangaroo.

From this serious difficulty schools of applied science and technology are, by the very nature of the case, largely freed. Indeed, the inapplicability of the scheme of examinations to the studies we are considering has even been made an argument against their introduction into universities. Professor Parsons Cooke, in addressing recently a body of students at Harvard, said: "When advocating in our mother university of Cambridge, in Old England, the claims of scientific culture, I was pushed with an argument which had very great weight with the eminent English scholars present, and which, you will be surprised to learn, was regarded as fatal to the success of the natural science triposes then under debate. The argument was, that the experimental sciences could not be made the subjects of competitive examinations."

acquired as such. The period of professional study is not too late for the acquirement of this faculty. It can even be acquired later still, in the course of professional work. Such practice, however, in my judgment, forms no part of general education and training, and is only vicious and mischievous in the culture stage.

It is not true that chemistry and physics cannot be made the subject of examinations *after their kind;* but it is true that, under competent teachers of these sciences, examinations have far less of the character of a cram, and far more of the character of a test of ability to do work. Moreover, in such a scheme of instruction, as a whole, examinations perform a much less important part, while the daily and weekly exercises in the laboratory become continually of more and more account as a means of ascertaining the scholar's real progress. In this the schools of applied science and technology comply with the demands of modern thought in pedagogics. In no department of life more than in education is there authority in the Scripture precept, "Let the dead bury their dead." The best examination which a student can pass is to show his ability *to do the next thing.* If he can pass this examination successfully, the teacher need give little thought to what has gone before. And I venture, by the way, to suggest, with reference to the urgent inquiry now proceeding as to where the American youth loses two years of time in his preparation for college, whether a large part, if not the whole of that serious loss, is not sustained from the everlasting reviews and examinations through which the American teacher, alike in the primary, the grammar, and the high school, insists upon dragging the pupil three times a year or oftener; thus not only requiring him to continually go over again ground already traversed, but, what is of more consequence, creating a sentiment throughout the

schoolroom which inspires the scholars to be forever looking back instead of forward.

The last of the advantages attendant upon scientific instruction which I shall enumerate,—though the list might be still further extended,—is found in a better relation between teacher and pupil. I would not willingly be guilty of exaggeration in this matter. With a really great and gifted teacher, the attitude of the scholar will always be that of respect and admiration, whether with or without affection and personal intimacy. But it cannot be denied that, in the traditional college, with the traditional subjects of instruction, the relation in question is likely to be less than a happy one. On the one side there is apt to be an undue assumption of knowledge, a tendency to dogmatism, and a too peremptory way of dealing with the pupil's doubts and difficulties. On the other side there is apt to be something of the tone of resistance, if not of resentment; a disposition to escape the teacher's scrutiny, if not to get around him with the petty tricks of the recitation-room.

It would be foolish to assume that there is any virtue in the natural and physical sciences which will overcome the faults or deficiencies of mind and heart that are found in some teachers. There are men who will be priggish, pompous, and pretentious in doing anything. But there is a wonderful virtue in the studies we are considering for bringing teacher and scholar together in their work in a most simple, natural, and affectionate relation. He is the most successful teacher of science

who puts himself in the attitude of discovering truth with his pupil, and of hunting with him for the object of their common search. Moreover, the very closeness of the contact in the laboratory of chemistry, physics, or mechanics, is such as to cause a continuous, insensible discharge of the electricity generated by the necessarily strict requirements of study and discipline, and thus to maintain the friendly relations of teacher and pupil, unbroken by those storms which sometimes gather and burst in colleges where the teacher sits buttoned up, on a platform, behind his desk, and lectures to his pupils from the chair of authority.

But it may be said: Considering all that may be claimed for the purely educational advantages of the scientific studies which run through the curriculum of the technological schools, why may not all these advantages be equally obtained by the student of the traditional college, and even to better effect, since there he may secure the pure gold of truth freed from the alloy of baser metal?—by which term the critic would designate the useful, practical applications of science. It is here that it behooves us to take issue, most directly and aggressively, with those who assert for the old-fashioned colleges an educational virtue superior to that of the schools we represent. It is of the very essence of our case that the directness and immediateness of application to which the studies of our pupils are subject, under their very eyes and at their very hands, constitute a tremendous educational force, securing a closeness and con-

tinuity of attention on the part of the pupil, an earnestness of effort, a zeal and enthusiasm of work, which it is utterly beyond the power of the teacher of classics or philosophy to arouse, except in the case of gifted students. If proof of this upon a large scale be needed, it is enough to refer to the well-known fact that law schools and medical schools invariably command the energies of their pupils in a far higher degree than do the colleges; and that hosts of young men who have idled and dawdled away the four years nominally devoted to classics and philosophy throw themselves with splendid enthusiasm into their professional studies when once they, for the first time, see upon what ends their efforts are directed, and how their energy and application are to promote their happiness and usefulness in life.

Even in the case of those young men who need no such incentive to secure their faithful attention and earnest endeavor, we yet hold that schools of applied science and technology possess a distinct advantage, in that their students learn the truths of science in a somewhat different way, and, in the result, know them somewhat better than do those who study these truths, no matter how diligently, without immediate, direct, and constant reference to their applications. Without dwelling further at this point upon the limitations and defects inherent in all academic systems of recitation and examination, I believe it to be true that the man who, in studying mathematics, for example, has only to

look forward to a recitation to-morrow and an examination two weeks or two months hence, applies himself to the subject necessarily in a spirit different from and with a result inferior to the spirit and achievement of the man who, continually as he acquires his mathematics, puts it to use day by day in the laboratory of physics, mechanics, hydraulics, or steam engineering.

For these reasons we must decline to accept the characterization of the technical applications of science as the alloy which debases the pure gold of truth. We look upon them, rather, as the tough, elastic bow which sends the keen shaft to its mark. And, be it remembered, zeal and enthusiasm of work are not to be valued merely because, or merely as, they secure directness of attention, continuity of application, and sustained endeavor. In themselves, of themselves, they are in a high sense an educational force, telling immediately and telling powerfully upon intellect and character, contributing importantly to build up mental and moral substance firmly and healthily.

There is one school in the United States devoted mainly to the application of scientific principles to a professional art, which is so well known to all our people, and whose work in the development of mind and manhood has been so severely tested in the sight of the country and of the whole world, that I cannot forbear to allude to it here. I mean the Military Academy at West Point. There is no reason to believe that, for the thirty years preceding the Civil War, the young men

who went to that school were in any degree superior to those who entered Yale or Harvard. Indeed, there was at that time, at least throughout the North, a certain disinclination on the part of the more generous and ambitious of our youth to adopt the career of arms. Yet when the war broke out, what a wealth of intellect and character was displayed by the graduates of that one small school during the terrific trial to which they were instantly and without preparation subjected! Think how many men from that single academy, which had fewer living graduates than either Amherst or Williams, led army corps and armies with distinction, on the one side or the other, in what was perhaps the greatest war of modern history! I said "of intellect and character," for it is character, even more than intellect, which enables the commander to bear the tremendous cares, responsibilities, and burdens of his office. What power developed, out of those few small classes of raw lads, a Grant, a Lee, a Sherman, a Meade, a Jackson, a Thomas, the two Johnstons, a Hancock, a Reno, a Reynolds, and a Sheridan, not to mention scores of others who "waxed valiant in fight" and commanded divisions and corps with a skill and address which have excited the admiration of the professional soldiers of Europe?[1] Doubtless

[1] Those four years of tremendous conflict had wrought the nation up to the appreciation of a greatness which does not manifest itself in fine phrases and moving utterance. If the war had done nothing else for our people, it would have done much simply in teaching them that deeds are greater than words. The American people, through those long days of anguish and suspense, learned how much higher and nobler is the power that can do and dare and

in some part it was the romance and the highly stimulating influences of the military career. Doubtless in part also it was the special inspiration of the tremendous occasion, fraught as that was with the destinies of a continent. But I believe it, in still greater part, to have been the perfectly natural effect of the application of perhaps not extraordinary powers to the thorough, patient, unremitting study of scientific principles, directed straight upon a worthy profession, under the tuition and guidance of renowned masters of that art, and under the constant influence of professional ideas, professional sentiments, and great professional examples.

Much more might be said in comparison of the influence of scientific teaching as carried on in the schools of applied science and technology, with the influence of the traditional or of the more modern, revised curriculum of the classical colleges; but perhaps enough has been said to justify the assertion that the former class of institutions is just as truly educational as the latter. Here I am content to rest my case. This conceded, let the youth of the land seek the one or the other kind of school, according to their individual tastes, predilections, and plans for life. I am far from being so bigoted as to suggest that there is not room enough in the educational system of the future for all the institutions of the elder

endure, than the arts of dainty expression, or vehement declamation, or cunning dialectic in which they had formerly so much delighted, too often to the point of subordinating statesmanship to oratory.—*From address delivered at the opening of the Engineering Building, Pennsylvania State College, February* 22, 1893.

type which have achieved for themselves a name in letters and philosophy; which have, with pains inexpressible, wrought out their own problems and created their own constituencies; and each of which has a host of eager, devoted alumni, ever turning gratefully to the halls in which they were nurtured. But I confidently look to see a largely disproportionate number of the new institutions which shall from time to time come into being, built essentially upon the plan which has achieved such prodigious successes during the quarter-century now closing. Doubtless the present general scheme of the schools of technology will itself undergo considerable modification, alike from the results of added experience, from larger means, and from the infusion of a wiser and more generous spirit. Doubtless more of economic, historical, and philosophical studies will be introduced to supplement, by their liberalizing tendencies, the work of the sciences in making their pupils exact and strong. Possibly some ultimate form for institutions of the higher learning may yet be developed, which shall embody much of both the modern school of technology and of the old-fashioned college, with, perhaps, something taken from neither, but originating in the larger, fuller, riper life of a happier and richer future.[1]

[1] In addition to all the professional uses which he may make of scientific principles or technical arts, the student thoroughly trained in exact science has acquired (first and foremost) intellectual honesty, —that is, complete satisfaction in resting upon the truth, whatever that may prove to be; then, the power of discrimination in all things

concrete and objective; next, the ability to concentrate attention, and to pursue investigation unfalteringly and relentlessly to exact results; finally, the mastery, in a high degree, of his own powers and faculties.

The things which scientific study and technical practice do not directly tend to give, but which philosophical studies do in a measure contribute, are, first, what I may call "horizon"—the outlook over affairs; secondly, toleration of and patience with what is poor in kind and incomplete in form, like much of what one has to do with in real life; thirdly, knowledge of men, and address and tact in dealing with them; fourthly, appreciation of economic conditions, especially in the matter of knowing where to stop in the perfecting of products, as at the point where it will "pay" best,—that is, where the return will most liberally compensate expenditure, in contrast with the scientific instinct to make everything perfect, no matter what it costs.

Now, if it were wholly a question between those two classes of advantages, so strongly contrasted with each other,—that is, if a man could not have both, in some degree, but must "cleave to the one and despise the other," I should unhesitatingly say, give to me and mine the advantages which especially attach to education and training in the exact sciences, even if we must forego those naturally to be looked for from philosophical studies. Not only are the former, on the whole, more valuable to individuals and to society, but they are doubly important in view of the consideration that one who has acquired the scientific spirit and the scientific method, who has become exact and strong, may be broadened and softened by contact with men and experience of life. But one is very unlikely to acquire the spirit and methods of science later in life if he has not done so in school; is very unlikely indeed to take up and master mathematics, mechanics, and physics, when engaged in active duties.

But it is not a question of taking the advantages which belong to one kind of education, and giving up those which belong to the other. There is no incompatibility between the two sets of qualities especially developed by the two sorts of training. A man may be liberal and broad in spirit, and yet exact and strong in his thinking. He may have the keenest possible sense of what is incomplete in form, yet be tolerant in dealing with the unavoidable imperfections of his material, or of his human agents or assistants. He may hold in view the perfect instrument, the perfect end, not less strongly because his economic sense instructs him that it is necessary to stop short at a certain point, in order to secure a return for labor and capital to be invested.

Not only is there no incompatibility between these different sets of qualities—each actually contributes to the other. Since, thus, a man may aspire to have both in fair measure, each in greater perfection and higher degree because of the other, it becomes simply a question of time and money to the student of science how far he shall pursue philosophical studies in addition to his principal work. —*From a Communication to "The Tech.," April* 9, 1891.

THE TECHNICAL SCHOOL AND THE UNIVERSITY

1893

An Answer to an Article Entitled "Relations of Academic and Technical Instruction," by Professor Nathaniel Southgate Shaler, Published in the *Atlantic Monthly*, August, 1893. From the *Atlantic Monthly*, September, 1893.

The main points of Professor Shaler's argument are sufficiently indicated in President Walker's reply.

THE TECHNICAL SCHOOL AND THE UNIVERSITY.

In the August number of the *Atlantic Monthly* Professor Shaler has discussed the relations of academic and technical instruction in a way which brings the reader to some startling conclusions. So great are the advantages which a technical school is shown to derive from association with a university, so heavy the liabilities to narrowness and smallness of aim and purpose in the case of an independent school, that those of us who are connected with technical schools not attached to universities find ourselves put upon our defense; and this, too, under very serious charges. If any large part of Professor Shaler's position can be maintained, we are offenders against the cause of sound education. It is our duty at once to seek the sheltering arms of the nearest university; or, if there be none near enough to take charge of us, then we ought to disband and to send our students to those who can do better by them. Professor Shaler does, indeed, admit that in a favorable environment a separate school may achieve a partial success; but he holds that this success is likely to be temporary, and at the best is attained through the sacrifice of important educational interests. In view of such a declaration by the dean of a technical school[1] enjoying the

[1] The Lawrence Scientific School.—Ed.

protection and patronage of a great university, it is imperative that those who have to do with detached schools shall speak in their own behalf. The controversy is not of our seeking; and we must be pardoned if we speak with frankness on all the points at issue.

In the first place, it may not unfairly be said that, if the advantages of a connection with a university are so great, it is inexplicable that the effect of this should not more clearly appear in the history of that school which Professor Shaler mentions as the first of its class to be established, and to which, through the whole extent of his article, he refers in illustration of his principle. Harvard, as he says, has exercised an admirable hospitality toward many true and useful forms of learning. Its scientific department was founded under peculiarly fortunate conditions: a handsome endowment, a noble name, a cultivated community, association with the oldest college in the country, proximity to the richest manufacturing district. All these things seemed to assure success; yet the Lawrence School graduated twice as many pupils in the first half as it has in the last half of its history. Meanwhile, scores of technical schools have come into existence, often under circumstances most adverse and with means painfully limited; have grown in numbers and increased in reputation throughout the general community; and have even come, in spite of prejudice, to command a high degree of respect and esteem from representatives of the old education. Does not this contrast fairly awaken incredulity as to

Professor Shaler's argument, if indeed it does not create a strong presumption that he has overlooked some element, or elements, vital to the case?

The strongest instance in apparent corroboration of Professor Shaler's views is that afforded by the Sheffield School of New Haven. Here is a scientific school, giving a large amount of technical instruction, which was founded in connection with a university and has achieved eminent success. Yet to anyone who knows the history of the Sheffield School, its experiences are directly in contravention of Professor Shaler's views, and indeed furnish the most important instance which could be cited against his position. Every Yale man knows that the Sheffield School grew up under the total neglect of the corporation of the college, for that body had nothing to do with the curriculum, and did absolutely nothing as to the selection of the teachers. During the eight and a half years of my connection with the Sheffield School[1] I but once saw the president of Yale in a meeting of its faculty, and that was by special appointment, with reference to the question whether the students should be required to attend morning prayers. So little had the school, in its early days, been considered by the corporation that when the Battell Chapel was erected, about 1873, no provision was made for giving the Sheffield undergraduates seats in it. Down to the accession of President Dwight the actual governing

[1] General Walker was Professor of Political Economy at the Sheffield Scientific School from 1873 to 1881.—ED.

body was the faculty, under the admirable chairmanship of Professor George J. Brush. The faculty made out the budget, cut down their own salaries whenever that was necessary, apportioned the funds for laboratory and general expenses, and selected the men who were to be appointed to positions which had become vacant or which it was deemed desirable to create. Not a single instance occurred where the choice of a professor was not solely and exclusively the work of the existing faculty. The appointment, in the legal sense, had of course to come from the corporation; but in no case did that body or the president take any initiative in the matter.

It was under conditions like these that the Sheffield Scientific School passed through the years during which its character was being molded and its scholarly traditions formed. I understand that Dr. Dwight, since his inauguration, has entered deeply into the questions relating to the Sheffield School and takes an active part in its councils. No more generous and comprehensive mind could be brought to the problems of any institution; and I am far from thinking that, with the traditions of the school already formed, the new *régime* will not be consistent with continued growth and prosperity; but I am fully convinced that Sheffield owes no small part of its brilliant success to the Cinderella-like abasement and neglect in which its work was begun and continued until the institution had passed from the gristle of youth into the solid bone of manhood.

So much for the Lawrence and Sheffield Schools as bearing on the issue which Professor Shaler has raised. Other technical schools have been founded in connection with universities, and some of them have done good work. But I know no reason for attributing to the School of Mines, in Columbia College, a higher character than that borne by the Stevens Institute, a detached school upon the opposite bank of the Hudson; while against the success attained by Sibley College, of Cornell University, may fairly be set the rolls of the alumni of the Rensselaer Polytechnic of Troy, the Rose Polytechnic of Terre Haute, and the Massachusetts Institute of Technology.

But let us leave the comparison of technical schools under the two systems, in order to examine the reasons, in the nature of the case, which are adduced as showing that connection with a university is not merely a favorable and fortunate condition, but a condition essential to the proper development and perfecting of every technical school. Professor Shaler's first plea has relation to the administration. He argues that a competent governing body is of the first importance in the career of any institution of learning; that it is very difficult to obtain a competent body; and that, therefore, when an able and successful administration has been secured for a university, it must needs be of great service to a technical school to come under that rule, and thus to be saved from the many possible and even probable disadvantages attendant upon an organization of its own

board of trust. What Professor Shaler says regarding the vital importance of a strong but liberal and comprehensive government is true. Yet, when we are considering the question of the government of a technical school, it must be said that there is one element of even more importance than the business ability or intellectual power of its administrators. This is that they shall be deeply interested in the work; that they shall thoroughly believe in technical education; that they shall unaffectedly and profoundly respect the kind of man who is to teach in such a school, and the kind of pupil who is to receive the teaching. Possibly this is one of the elements which Professor Shaler has overlooked. Possibly in this respect there has been some failure among corporations or boards of trust composed of men bred in the old education, and having their standards and ideals of character and of conduct shaped by the influence of classical culture. Possibly this explains the comparative failure of some technical schools connected with universities. Professor Shaler admits that "still, to this day, the tendency has been to regard this department of instruction as something much below the university grade." Until that tendency shall have been completely arrested, and even reversed, may it not be better that this department of instruction shall be under the control and direction of its own devoted friends? For myself, I believe that scientific and technical education always encounters a grave risk when put out to nurse with representatives of classical culture.

Moreover, conceding, as has been done, the difficulty of securing an adequate governing body for any institution of learning, it may yet be said that this difficulty is not insuperable. The Institute of Technology has had among its trustees, to mention none of the living, men like Jacob Bigelow, Erastus B. Bigelow, John D. Philbrick, James B. Francis, George B. Emerson, J. Ingersoll Bowditch, Charles L. Flint—men fit to take part in the deliberations of senates or of universities, able in business, large of view, and faithful to every trust. If other technical schools, less fortunately situated, have suffered somewhat from the lack of liberal and comprehensive administration, it must be remembered that the same is true of all the smaller colleges of the land. If detached technical schools are to be given up on this account, so must these. Yet who does not believe that, in spite of limited opportunities and means, our smaller colleges have done a truly glorious work for mind and manhood?

The second advantage, or group of advantages, which Professor Shaler attributes to a technical school under the patronage of a university may be said to relate to the students as distinguished from the governing body. The subject is necessarily somewhat vague. I am not sure that I rightly apprehend Professor Shaler's meaning at all points; but, so far as I can gather his views, he thinks the pupils derive a benefit in each of the following ways:

First, the student in such a school finds himself, in

classes pursuing certain subjects essential to his course, in company with students not intending to adopt technical professions. These subjects may be, for example, chemistry, geology, physics, or mathematics—subjects which form the groundwork of technical courses, and which may also be pursued by college students as a part of their general training. Professor Shaler regards this association as a source of much advantage, applying to it the term "educative companionship." I confess that, unless it is to be presumed that the non-technical students are the better men or the better scholars, this idea appears to me very far-fetched. The notion that because a young man is going to enter, two or three years hence, a law school, a medical school, or a divinity school, he therefore contributes some special flavor or savor to his class in chemistry, or physics, or geology, or mathematics to-day, is carrying the doctrine of final cause to an extreme.

There is only one assumption upon which this plea, conceding the equal merit of the students engaged, can have any validity. That assumption is often made by advocates of the old culture; but I am reluctant to believe that Professor Shaler could possibly adopt it, although he seems to do so when he speaks of "a truly academic atmosphere" as "one in which knowledge and a capacity for inquiry are valued for their own sake, and not measured by their uses in economic employment." The fling at technical studies as less "disinterested" than studies which are pursued without a direct object

is one which has often been made in recent educational controversy; but those who use it have not seemed to me to show thereby their own superior liberality of mind.[1] A young man who is faithfully seeking to

[1] The practical uselessness for any immediate purpose of a given subject of study may be no reason why it should not be pursued; but, on the other hand, the high immediate usefulness of a subject of study furnishes no ground from which the educator of loftiest aims and purest ideals should regard it with contempt or distrust. In either case, the question of real import is in what spirit the study is pursued. The most distinguished French writer of to-day on matters of education, writing, too, in advocacy not of physical but of social science, has frankly paid his tribute to the disinterestedness of spirit and loftiness of motive which promote and direct scientific research, even in its most practical applications. "Let us," he says, "pass in review the great founders of modern science and the creators of industry, the Keplers and the Fultons, and we shall be struck by the idealistic and even Utopian tendency peculiar to them. They are, in their own way, dreamers, artists, poets, controlled by experience."

And if, leaving abstract reasoning, we turn to contemplate the manner in which the several professions are practiced in the community, I seem to find corroboration of the view that the study of science and its applications to the arts of life do not tend to produce sordid character or to confine the man merely to material aims. Every profession has its black sheep and its doubtful practitioners, but, while frankly admitting that there are mercenary physicists and chemists for revenue only, I boldly challenge comparison between the scientific men of America, as a body, and its literary men or even its artists, in the respects of devotion to truth, of simple confidence in the right, of delight in good work for good work's sake, of indisposition to coin name and fame into money, of unwillingness to use one thing that is well done as a means of passing off upon the public three or four things that are ill done. I know the scientific men of America well, and I entertain a profound conviction that in sincerity, simplicity, fidelity, and generosity of character, in nobility of aims and earnestness of effort, in everything which should be involved in the conception of disinterestedness, they are surpassed, if indeed they are approached, by no other body of men.—*From Remarks at the Dedication of the New Science and Engineering Buildings of McGill University, Montreal, February* 24, 1893.

qualify himself for an honorable and useful career in life may be disinterested in every sense in which that word can be used with approbation. Disinterestedness, in its true meaning, depends, not upon the studies pursued, not upon their immediate usefulness or uselessness, but upon the spirit in which the student enters upon and pursues his work. If there be intellectual honesty, if there be zeal in investigation, if there be delight in discovery, if there be fidelity to the truth as it is discerned, nothing more can be asked by the educator of highest aims. With such a student the useful applications of science distinctly add to the educational value of scientific study, inasmuch as they give a more direct object to his efforts and exertions, and heighten the pleasure he feels at each step of his scholarly progress.

The next advantage under this head which Professor Shaler finds in technical schools under the patronage of universities is in the opportunity afforded to the pupils to mingle some philosophical studies with those which are essential to their professional courses. In this connection it must be confessed that the faculties of many, perhaps of most, technical schools have made a mistake in not providing more so-called liberal studies. I agree fully with Professor Shaler in the opinion that such a union would conduce to ultimate professional success, as well as to the greater happiness of the man and the greater usefulness of the citizen. But the mistake referred to may be fairly attributed to the youth, and also,

in some measure, to the poverty of the technical schools. That it is not in the nature of the case is shown by the curriculum of the Institute of Technology, where literary and philosophical studies extending over three years are required of all candidates for a degree. Of the Sheffield Scientific School, in this respect, it is enough to say that its students have for twenty-five years enjoyed the teaching of William D. Whitney and Thomas R. Lounsbury.

Another advantage which Professor Shaler discerns as attaching to professional schools under the patronage of universities is not easy of description or definition. It may, perhaps, be expressed by the single word "atmosphere." That there is something in it no one will deny; but the utmost benefit which the students of a technical school can derive from this source may easily be offset, many times over, by disadvantages arising from other sources. The history of Amherst, Dartmouth, and Williams, and of many other American colleges abundantly shows that the best atmosphere for a student is that which he himself brings to college with him in his own energy, fidelity, and scholarly zeal; that the next best atmosphere is that created by learned, laborious, and high-minded teachers; the next best, that created by a body of devoted fellow students, all intent upon the work of preparation for life. Loafing in academic groves or browsing around among the varied foliage and herbage of a great university, pleasant as it may be, and well enough in its way, will have little effect

upon the making of the man, in comparison with influences more serious, more pervasive, more penetrating.

That the students of technology throughout our country do, as a body, apply themselves to their tasks with wonderful energy and enthusiasm is a fact so familiar that it hardly needs to be adverted to here. The accession of such students to a great university would doubtless do much good to the university; but that the technical school would be better for the association may be questioned, in view of the multitude of distractions which beset ordinary student life and the frivolity of many of the interests which are there deemed of prime importance. On their part, young men do not greatly care to go to schools where they are not respected equally with the best; where all the praise and all the prizes go to others; where the stained fingers and rough clothes of the laboratory mark them as belonging to a class less distinguished than students of classics or philosophy. Professor Shaler remarks upon "ancient prejudices concerning the humble position of all mechanical employments." Is it quite certain that those prejudices are even yet so far worn out of the public mind that the students and teachers of technology may not feel more at ease by themselves, in schools devoted to their own purposes, than in schools where snobbishness makes odious comparisons, and where fashions are set in respect to student life, conduct, and dress which they have neither the means nor the inclination to imitate?

With much of what Professor Shaler says regarding

the desirability of preparing young men for the technical professions more by inculcating principles and inspiring a zeal for investigation and a love of learning, and less by imparting mere information and teaching useful knacks and devices, I heartily concur. Too much cannot be said upon this theme. But the question does not necessarily concern the issue raised by Professor Shaler. More than one detached school has shown the liberality of sentiment, the comprehensiveness of view, and the high moral courage necessary to place and maintain technical education upon a lofty plane.

THE RELATION OF PROFESSIONAL AND TECHNICAL TO GENERAL EDUCATION

1894

An argument against the thesis that a liberal education should embrace three separate zones: disciplinary, liberalizing, professional or technical. From the *Educational Review*, December, 1894.

THE RELATION OF PROFESSIONAL AND TECHNICAL TO GENERAL EDUCATION.

Last winter I listened to an address from a gentleman of the highest distinction, connected with the educational interests of New England, on the subject of "A Liberal Education," of which the leading thought was that, in an ideal course of education, a young man would pass successively through three stages: first, disciplinary; second, liberalizing; third, professional or technical. According to the view presented, these three stages are passed, with us here in America, successively in the preparatory school, that is, the high school or so-called academy; in the college; and, finally, as the name implies, in the professional school, whether of law, of medicine, of divinity, or of technology.

In the middle term or stage of this course—that is, in the college—it was the view of the speaker that the liberalizing studies should be pursued with a good deal of range as to choice of subjects, and of leisure as to the time devoted to study, to reflection, to enjoyment of work, and even to enjoyment of sport and play. Freedom, a considerable degree of freedom, involving, as was said, both liberty of choice as to the subjects of study, and leisure as to the application of the student's powers, the occupation of his mind, the use of his time,

was, if not an essential of the liberalizing effect, at least a most favorable and felicitous condition.

Looking at this scheme from beginning to end, as related to the existing organization of American schools and higher institutions of learning, several questions suggest themselves in a way to cast some doubt upon the apparent harmony of the educational process depicted.

The first is, whether our high schools and academies can be given the credit of bringing their students up to the grade of thoroughly disciplined young men; whether the graduates of Exeter and Andover, Easthampton, the Boston Latin School, and the ordinary American city high school, can safely be assumed to have passed through a sufficiently long and severe disciplinary process to make it desirable that, immediately upon entering college, they should be subjected to the relaxing process; be treated in every way as well-trained men; be afforded large choice as to subjects of study and as to the mode of pursuing the subjects chosen, with abundance of leisure for intellectual enjoyment, and even for sport and play. I confess that this seems to me rather a roseate view of our academies and high schools. Even if it be conceded that the graduates of such schools have already had quite enough of mere grammatical and mathematical drill, and that the full time has come for them to be exercised in studies appealing to taste and sentiment, in studies of an especially liberalizing tendency, it seems to me fairly a question whether their

tasks, in this stage of education, should not still be made to have a distinctly disciplinary character. Can a young man be said to have passed through the disciplinary period until he has been subjected both to mathematical and grammatical gymnastics, and to hard, positive training in the elements of logic, philosophy, and classical scholarship on the one hand, or of physical or natural science on the other? From my own observation of several classes leaving a preparatory school, and of several times that number of freshman classes entering a college or technical school, as well as from reflection upon the nature of the case, I should not be disposed to answer the foregoing question in the affirmative. On the contrary, I believe that the first two years of the ordinary American college course should be regarded as belonging distinctly to the disciplinary stage, in which the subjects of study should be prescribed by teachers to pupils; in which lessons should be regularly assigned and recitations punctiliously exacted, the idea of mental exercise and training forming still the predominant motive on the part of the instructor. In saying that, in this stage of education, subjects of study should be prescribed by teachers to pupils, it is not meant that the same subjects should necessarily be prescribed to all pupils. Consideration might be had, in a large degree, of individual aptitudes and inclinations.

A more fundamental objection to the view of college life to which I have called attention is found in the length of the term assigned by it to the stage of educa-

tion in which a considerable degree of leisure is to be allowed the student as a liberalizing influence. If all our young men came up to college at eighteen years of age with thoroughly well-disciplined minds, I should still be disposed to doubt whether four years could be spent to advantage by any of them without a strong daily sense of present obligation, and without a considerable pressure from duties rigorously exacted. None of us would grudge to a young man, at some time or other, before his entrance into real life, or before beginning a severe course of professional preparation, as much as a year of leisure, especially if it could be combined with opportunities for travel, or with studies in art, music, and fine letters. But it may be doubted whether any young man was ever the better for four years of drifting and comparative aimlessness and idleness, even though no distinctly bad habits were formed in that period. If, in single instances, so long a period of leisurely study not directed upon an object, and with no severe and constant pressure from without, should prove to be just what a peculiarly felicitous organization might require, a teacher might well fear that, with a great majority of the members of any college class, the habits of mind thus formed would be seriously injurious in subsequent professional study and professional practice. There could not fail to be danger that, after so long a relaxing process, many young men, not of heroic mold, would fail to pull themselves together again, and would enter upon the real duties of life with somewhat

less of energy, of incisiveness, of self-control, of self-command, than is needed by those who are to do real work with all their mind and with all their might.

But I am obliged further to raise the question whether freedom, in the sense of comparative liberty of choice and comparative leisure in study, involving the absence of severe and punctilious requirements on the part of the teacher, is any necessary condition, at all, of a truly liberalizing process. I would not seek to disparage in the slightest degree the value of liberal or liberalizing exercises, whether with reference to personal happiness and social influence in after-life, or with reference to subsequent professional labors. Merely for business success in the most distinctly technical profession, philosophical studies are of great importance. In none of the higher walks of life does it ever cease to be more the question how much of a man one is, than how much he knows of his special business. And this is even more distinctly true in the engineering profession, for example, than in the law. A great lawyer generally is a great man, but he need not be: there is a melancholy abundance of instances to the contrary. But a great engineer must be a great man. All great engineers, according to the testimony of those who knew them, have been great men. The greatest engineers of the world's history have been very great men. The responsibilities they have had to bear, the choices they have been called to make between widely different ways of reaching the object sought, the portentous conse-

quences of any mistakes they might commit, the unique character of every important engineering work, which reduces the value of precedent to a minimum, and, I might add, the fact that in a large proportion of important engineering enterprises it is the faith and courage and enthusiasm of the engineer which carry his constituency with him and cause it to be decided that the work shall be undertaken and the means found—all these conditions make demands which can be met only by men of calm mind, of large views, of highly conservative yet boldly daring temperament, of thorough self-mastery, of great power over others. These are in part the gifts of nature; but they are also, in great part, the fruits of culture.

My contention is, therefore, not against the introduction of liberal studies, upon the most liberal scale, whether for cultivation or as a means to subsequent professional success, but only against the assumption that liberal studies, to secure the best effect, must be pursued with a special degree of liberty of choice and with leisureliness of effort. On the contrary, I am disposed to hold that *liberal studies should be severely pursued;* and that for the highest results, the more liberalizing the tendency of any intellectual exercise, the more is it to be desired that it should be followed out with energy, with closeness of application, with punctiliousness of performance, with careful scrutiny of the results obtained. Certainly, the men of our race who have most conspicuously illustrated the virtue of mental cultivation do not

make upon us the impression that they won their grace and power easily and lightly.

But is this theory of separate zones through which the student should successively pass in the course of his education tenable in any part? I do not question that the terms, disciplinary, liberalizing, and professional, may be applied to three stages of intellectual progress; but I should admit these terms only as characterizing the preponderant nature of the exercises pursued during these successive stages. It is the greatest single fault of our academies and high schools to-day that their curriculum contains so little of philosophical and liberalizing studies. Those schools will not do the work which the student requires between fourteen and eighteen, or between fifteen and nineteen, years of age, until liberalizing, as distinguished from disciplinary, studies are taught in them in large amount and by masters who can command the attention, awaken the interest, and direct the utmost scholarly efforts of their pupils upon themes which appeal to taste and sentiment, which arouse enthusiasm, which train the student to weigh evidence, to balance probabilities, and to form conclusions for himself. When one remembers the subjects to which, sixty years ago, college boys of only fifteen and sixteen years of age applied themselves, and to which, thirty years ago, college boys of only sixteen and seventeen years gave no inconsiderable part of their time, either in the recitation room or in the literary or debating society, it seems absurd to-day to see great fellows of nineteen

come up to college who have hardly ever been addressed upon philosophical themes, almost their whole educational experience having been limited to grammatical and mathematical drill or to the acquisition of positive information, most of which should have been allowed to rest undisturbed, until required for actual use, in the gazetteer, the cyclopedia, and the classical manual. It is from this point of view that the procrastination of the age for entering college appears most to be deprecated. It is not primarily the loss of time which one regrets, but the fact that the liberalizing studies are introduced so late. No boy ought to pass the age of sixteen without being addressed on philosophical themes, without being taught to reason, without being made to interest himself in subjects of the highest moral and social importance. So much everyone must admit. For myself, I go farther, and would say that almost the only limit to the advantageous introduction of liberalizing studies into the academy and high school is to be found in the difficulty of securing teachers competent to awaken the pupils' minds and to present the higher themes of thought and reflection in a simple and attractive manner. That is my first criticism of the theory of educational zones.

On the other hand, I see no harm, but rather a distinct advantage, in having the studies of college intimate and introduce those of the professional school. Of course, this can be done only when the choice of a profession has already been made; but, where, as in a large

proportion of instances is the case, the college student knows what his occupation in life is to be, no small part of his time in college may, without any loss of liberalizing influence, be directed straight upon that end. If the student is to go from college to a law school, why should not his college studies be largely determined by that fact? Not that he should anticipate in the slightest measure the technical study of the law; but I would have a broad foundation laid for it in the extensive cultivation of history, of economics, of ethics, of logic and philosophy, and perhaps of Roman law. If, on the other hand, the pupil looks forward to becoming a physician, he might advantageously devote a part of his college course to biology, botany, physiology, and chemistry. These studies are admitted by nearly all candid educators to be as truly of a liberalizing and uplifting tendency, at least for those who have a natural inclination toward them, as are the traditional exercises of the classical college, at least for such as have not a natural inclination toward them. Certainly, among the men of our own race, no finer examples of cultivated manhood can be found than in the ranks of those who have been eminent in natural history. Again, the pupil who looks forward to a school of engineering, upon the completion of his college studies, might very well devote a large part of his total time to mathematics and physics, studies which, when properly pursued, are truly liberalizing, refining, and elevating.

It might be supposed that the recommendation that, so

far as the plans of the pupil will admit, college studies should intimate and introduce the subsequent work of the professional school was offered with a view either to shortening the term of professional study or to making possible a larger amount of professional attainments in the result. And, indeed, there appears no sufficient objection to securing in this way the double object of mental expansion and cultivation, and a fortunate introduction to and preparation for professional study. Yet, in making this suggestion, I have chiefly in view another and a higher object. Through such a use of the college term, the student would enter the professional school with broader views and with a nobler ambition. It seems not altogether for good that a young man should, in effect, say, "I have finished my term of liberal education; I will now turn, in a different spirit and with a different purpose, to take up my direct preparation for professional life." By such a system as has been suggested, a young man who in college had become thoroughly interested in history, economics, ethics, logic, and philosophy, would not feel that he was breaking off his course, or was taking an essentially different direction when he entered the law school. On the contrary, would he not begin his new work, not only with a certain valuable preparation which would be found useful through the whole extent of his legal studies, but with a larger comprehension of the social relations of his proposed profession, with the capability for a keener appreciation of his law school studies and exercises, and with

a higher professional ambition? Would not the same be true of a student going to a medical school from a college in which he had largely devoted himself to biology, botany, physiology, and chemistry; in which he had acquired not only a certain amount of knowledge that would become of professional use, a certain skill with the microscope and the instruments of dissection, a certain instinctive aptitude for experimental work, but also a great enthusiasm for natural history, a profound respect for its masters and investigators, a keen delight in experiment and discovery?

Finally, coming now to the professional school, it appears to me that it should not be the view of those who lay out its courses and arrange its exercises, that either the disciplinary or the liberalizing work of education has been completed. So far from this, I would have those who control and administer the law school, the medical school, and the school of engineering, consider it their primary duty to train the powers of the pupil, to widen his outlook over life, to secure for him the conservative influences of culture, to expand and enrich his mind, both for his own greater happiness and for his higher usefulness to society. Speaking as the head of a professional school, I say in all sincerity that those professional schools will best accomplish their strictly technical purposes which send their graduates out into the world with broad, well-balanced minds; with the faculty of judgment strengthened by the mastery of principles more than by the acquisition of information; with tem-

peraments chastened to the true union of conservatism and enterprise by study of the best examples from practice; and even with fine tastes and high aspirations.

Reference has been made to the conservative influences of culture. It is the one fatal weakness of the self-made man that, at any point in a successful career, there is a liability to collapse, or to the commission of first-class errors almost beyond the power of the well-educated man to commit. The ghastliest mistakes of life are those of self-made men theretofore successful, whether in war, in politics, in professional practice, or in business. It might almost be said that the greater the degree of previous success, or the more uniform that success, the greater becomes the danger that, at some critical point, the self-made man will overestimate his own powers; or foolishly despise some really formidable antagonist or competitor who does not answer to his notions, derived from a limited experience, of what may make an antagonist or competitor formidable; or underrate some evil liability because it is of a novel type; or take one thing for another on account of some superficial resemblance; or in some other way commit the capital blunder of his life. And it is true, also, that the fatal errors of self-made men largely occur after the period of life when they might perhaps have been repaired. The educated man makes his mistakes at or near the start. The self-made man is more likely to make his when it is too late either to learn from them or to surmount their consequences.

Permit me to illustrate my views regarding the professional school as a place where mental discipline and mental culture are still the first considerations, by a somewhat free reference to the action recently taken by the authorities of a distinguished American university in respect to its law school. For many years, it is well known, Columbia College maintained a law school which, of its type, was not surpassed or perhaps equaled in our country. A very remarkable amount of both teaching and executive ability had been employed in securing for it a pronounced success in carrying out its fundamental plan of instruction. Of late, however, under the administration of President Low, this school has, in effect, been cut off from the university; and a school of a very different type, more closely resembling the law school of Harvard University, has been organized in its place. This action of Columbia College is one at which all friends of education should rejoice. It may be that there is in New York, and perhaps in other large cities, a need of law schools like that so long maintained, with such remarkable success, under the deanship of Professor Dwight: law schools in which young men who have not the time or means to fit themselves fully, in a large and liberal way, for that dignified and honorable profession, should be enabled to acquire, rapidly and effectively, the elements of the law, and to pick up knowledge enough to enable them to pass the bar examinations: perhaps later, in the course of practice, to make themselves learned and accomplished law-

yers, perhaps not. But such an establishment ought not to be connected with a university. No university has the right to maintain any school in which the primary object is not to make the pupils scholars in some high sense of that term; in which learning is not to be loved and honored for its own sake, as well as for its practical uses; the atmosphere of which shall not be highly academic; in which much shall not be taught which the student may not have reason to employ in the early stages, or perhaps in any stage, of his professional career; in which more importance shall not be attached to the mastery of principles than to the gaining of information or to the acquisition of precepts, formulæ, and the useful knacks and devices of a trade. It is not merely that men who are trained in schools maintaining a high academic character are certain, in the long run, to achieve a greater professional success: an even stronger reason, still, is found in the consideration that men thus educated are certain to contribute in larger measure to that dignity and *esprit de corps* which constitute the savor of any profession, preserving it, if anything can, from corruption and degeneration, from unworthy arts and disreputable practices.

The question has of late been actively discussed whether, for the best effect, technical schools should be connected with universities. The reason of the case seems to differ not a little with reference to different classes of professional schools. The history of our country does not teach that this connection is highly im-

portant in schools of divinity. The schools of this class which have exerted the greatest influence upon the life and thought of the nation have been separate schools, or have been connected with universities by a very slight tie. Possibly one might say that the reason for the comparative success of separate schools of divinity has largely passed away with changed professional conditions and with even greater changes in the public thought. Seventy years ago, forty years ago, the ministerial profession had much more of an unworldly character than it has to-day; and there was a certain and a large advantage, according to the ideals of the times, in keeping the students of divinity apart by themselves, in an atmosphere of their own, where they should be as little as possible subject to influences which might have been deemed discordant with the proper sentiments of the theological seminary, or might have interfered with the profound and lasting impression which the masters of theology desired to make upon their pupils. To-day the clergyman is largely a man of affairs; the importance of denominational tenets is greatly reduced, even in the minds of theologians: and it seems not unreasonable to say that these changed conditions fairly remove some part, at least, of the special advantage formerly enjoyed by the separate schools of divinity.

In respect to schools of medicine, the evidence derived from past experience is conflicting. Certainly, some of the strongest schools of this class in the United States have held, at most, but a nominal relation to universities.

On the other hand, as it appears to me, a layman, there has always been a certain leadership by schools intimately connected with universities and under strong academic influences, notably in the case of the Medical School of Harvard. There seems little reason to doubt that the developments of the future will be mainly, if not wholly, in the direction of medical schools vitally related to our leading universities, and owing a large share of their scientific spirit and professional enthusiasm to such a relationship.

It is in respect to law schools that the considerations favoring the union of professional schools with universities attain their greatest force. The clerical profession is, by the very definition, a consecrated profession; and those who pursue it must come and remain under influences which promote disinterestedness and self-devotion. The medical profession is, in the nature of the case, at least a semi-consecrated profession, the intense interest of the physician in the welfare of his patients and in the relief of pain and suffering necessarily constituting a powerful force, which, in spite of the disturbing influence of specialization, tends to make the practitioner in a high degree disinterested and to draw him on from stage to stage of true professional advancement. The legal profession, on the contrary, alike through the tendency to constantly increasing specialization, through the great rewards to be reaped by professional success, and through the large opportunities afforded for sharp practice and unworthy arti-

fices, is always in danger of degenerating into a selfish, money-making, and unprincipled pursuit. Painful illustrations of this tendency are constantly appearing. Under such conditions, everything that makes the law student more scholarly, that gives him a higher respect for his profession, that furnishes him with motives and incentives to high-mindedness and unselfishness in practice, must be for the good of the profession and the community. And it is here that the influence of the university may be exerted to profit.

In the case of the engineering school and the school of technology, the considerations which should affect us differ not a little from those which stand related to the classes of schools already mentioned, owing to the existence of ancient prejudices, not yet outworn, in the minds of the general community and especially of those who control our higher institutions of learning. The school of law, the school of medicine, the school of divinity are all academic by tradition. Schools for these classes have for centuries been connected with universities; their characteristic studies have won a place in public estimation; proficiency in those studies has long been recognized by the conferring of the highest academic degrees; students of these schools stand in a position of honor before the undergraduates of the proudest university. With the school of engineering or of technology the case is different. The professions for which they prepare their pupils are new; and the exercises by which the student is trained in them are still subject, in some

degree, to antiquated and snobbish prejudice. I have no desire at this time to go over the ground of my controversy, a year ago, with Professor Shaler of the Lawrence Scientific School;[1] but will content myself with remarking that no advantages which could possibly result to a school of engineering or technology from association with a university—and those advantages need not be characterized as slight—will compensate for the disadvantages of such a union, if there is to be any failure on the part of the administrators and governors of the university profoundly to believe in the kind of education given in such a school, thoroughly to respect the sort of man who is to study in such a school and the sort of man who is to give the instruction, and in all ways to magnify and exalt the dignity and importance of the professions for which such a school prepares its pupils. And again, if there is to be among the body of students at a university any lack of consideration for the technical student, any disposition to look upon him as preparing himself for a work of less dignity and importance than that of the so-called learned professions, any of that snobbishness of feeling which sometimes leads young men to look upon the soiled fingers and rough clothes of the laboratory or machine shop as badges of social inferiority, then it is certain that students and teachers of technology will be more at ease by themselves, in schools devoted to their own purposes.

[1] See *The Technical School and the University*, p. 37 *ante*.

I have thus far spoken of the relations of technical and professional to general education in a series of schools represented by the academy or high school, the college, and the professional school. I come now to a more difficult question, about which, as more difficult, I shall have not more, but less, to say: namely, what shall be the relations of technical and professional to general education in cases where the college drops out altogether; where young men find themselves without the time or pecuniary means to interpose any course of study between the high school and the professional school? It is well known that this is the condition of by far the greater part of those who at any time in this country are fitting themselves for professional life. And this statement is equally true whether we take all classes of professional schools together or take each class by itself. As I can claim to know little of schools of law, medicine, and divinity, I shall confine my remarks to schools of engineering and technology.

When Mr. Abbott Lawrence made his munificent gift for the endowment of the Lawrence Scientific School, it is plain that the students of that school were expected to be, in the main, college graduates who had received their training and cultivation at Harvard or some other of the old-fashioned colleges of those days. This expectation has been altogether disappointed. In the last list of the students of the Lawrence School which I have examined appear the names of only eight college graduates. The Sheffield School at Yale has suc-

ceeded in retaining a certain number of graduates from its own three-years' course, and in attracting a few graduates of Yale College and of other institutions; but its last catalogue shows the proportion of graduate students to be but about seven per cent. Of recent years, the proportion of graduate students at the Institute of Technology has been four or five per cent., rising, the present year, to seven. It is clear, therefore, that we are to look upon the schools of applied science or technology as having, by the necessity of the case, to serve their students both as colleges of culture and as professional schools; the only alternative being that, if these schools refuse the office of promoting the mental development, training, and culture of their students, those young men must go altogether without the advantages which the college man seeks in college. Our question, then, is: can the school of applied science or technology, in any part,—and if so, in how large a part,—make up to the student the loss of a college course?

In the first place, one may venture to inquire whether the loss is, in point of fact, as great as might at first appear. Conceding fully that college life is a very charming thing at the time, and that the recollections of it and the associations formed through it add much to the pleasure of subsequent existence; conceding that every parent would gladly secure for his son this privilege if his means allowed, are we bound to state the loss of time, for all effective purposes of mental discipline and cultivation, in the case of those who miss a col-

lege course, at full four years? I should be disposed, from my observation of the average college student, to put the loss at very much less than this. But, whatever the estimate of loss, can the school of applied science and technology afford the diligent student an opportunity to make up a part of what he has missed in not going to college? Are the necessary requirements of professional preparation such and so great, that the student of one of these schools must feel that this part of his education has been entirely sacrificed; and that he must content himself with a practical preparation for professional success, accepting a certain and a considerable deficiency upon the side of mental discipline and cultivation, as a part of his lot in life?

To the foregoing question I have no hesitation, as the result of my own observation and reflection, in giving a negative answer. For all the scientific professions which I know anything about, the best technical preparation is that which will also prove to be predominantly of a truly educational character, expanding and enlarging the mind, disciplining the powers, and fitting its subject for manhood and citizenship.

The question, how far immediate professional success is to be weighed against ultimate professional success, has already been decided, by our large American experience, in favor of a decided preference to be given to the latter. It is, of course, an immense advantage to the students of technical schools, and to their parents and friends, that the young graduate is at once able to earn

his livelihood.[1] In this day, when social necessities are so grinding, and when it is so hard to start a son in life, that advantage is not to be neglected. Yet there is always a wide field of choice open to those who control

[1] As to the salaries received by our graduates [of the Massachusetts Institute of Technology], individually or as a body, I have almost no information. It is a subject which has never concerned me in the least; and I have not even taken the trouble to collate and preserve whatever information has come to me casually. I presume it is with the engineering profession and the architectural profession as it is with the profession of lawyer or doctor, namely, that there is a certain number who attain the prizes; and another very much larger number who realize an immediate and comfortable support; and another, I should hope a very much smaller number, who simply get on. We all know that there are hosts of lawyers and doctors who earn nothing but the barest living, even if they pay their office rent. I see no reason why the same should not be true of engineers or architects or chemists. If a man will simply go on surveying, year after year, continuing indefinitely to do what any young man a year out of a technical school can do fairly well, there is no reason why he should receive a very high salary for the service, since the number of persons who would be glad to do this at a moderate compensation would be very large. There is no mystery or magic about a scientific profession. Such an education as we give here enables a man, after a few years' experience, to take the very highest positions in the direction of business and in the conduct of industry; but a man has to do something in this world besides qualify himself for advanced positions. He has to seek them and to find them. He must have the tact, the *savoir faire*, the energy, the patience, the good sense to make his way; exactly as would be the case with the well-educated young lawyer or young doctor. No school makes a man. All it can do is to take the man as he comes to it and fit him by training, by practice, and by information imparted, for whatever duties he may encounter in his professional life. The man has still to make his own career. The fact that he has professional standing at the start gives him an advantage over the college-bred man in getting a living for the first two or three years. After that the rate at which he shall go forward will depend entirely upon his capacity, energy, fidelity, and tact.—*From a letter to an intending student*, 1896.

technical schools, as to the degree in which they will offer to their pupils studies and exercises the value of which will be most fully realized in the first few years after graduation, or studies and exercises whose value will be increasingly felt through the whole course of their professional careers, and which will qualify them, in larger and ever larger measure, for positions of responsibility and trust, with advancing years. Such studies and exercises are almost wholly of a nature to afford mental discipline and culture in a very high degree. It would be strange, indeed, if in the infancy of technological education, mistakes had not been made in this matter, the teacher, in his eagerness to fit the student for professional life, assigning too much value to those things which are of immediate utility. But I feel confident, from a careful study of institutions of this class in the United States, that this error has already been very largely apprehended, in all its seriousness; that among those who administer technological education, there is a decided movement in the direction of subordinating the acquisition of the knacks of a trade and mere technical devices to the study of principles; and that, even in the applications of principles, valuable, and invaluable, as these are in technological education, reference is now had rather to their effect in giving a greater mastery of the principles themselves, than to their immediate utility in professional practice. Nay, more, I confidently believe that even in the study of scientific principles themselves, a continuously increasing regard

will be paid to their influence in expanding the mind, enlarging the view, elevating the aims, and strengthening the character of the pupil.

But we should not trust alone to the study of scientific principles in a technological school for making good to the pupil the loss of a college education. There should be introduced into all technical courses no inconsiderable degree of purely philosophical study. The experience, during twenty-nine years, of the school with which I have the honor to be connected, shows this to be entirely feasible. No one has ever received the degree of the Massachusetts Institute of Technology who has not, in addition to all scientific and technical studies and exercises, taken substantial courses, extending through at least three years, not only in modern languages, but also in history, literature, and economics. Of course, under the conditions existing, a large amount of time cannot be assigned to such studies; but if they are pursued with the zeal and earnestness which characterize the students of these schools, much can yet be done in a limited period. As before remarked, liberalizing studies need not be followed out either in a loose or a leisurely manner. With a proper arrangement of subjects and with good teachers, it is entirely possible for those who administer the institutions of applied science and technology to give their pupils, in addition to the studies and exercises which will make them resolute, exact, and strong, at least a moderate measure of the studies and exercises which will make them also broad and high and fine.

TECHNOLOGICAL AND TECHNICAL EDUCATION

1896

An Address Delivered at the Dedication of the Clarkson Memorial School of Technology, Potsdam, New York, November 30, 1896.

President Walker's last public address upon education.

TECHNOLOGICAL AND TECHNICAL EDUCATION.

In reading recently the very valuable work entitled *Notes on North America*, by Professor J. F. W. Johnston, of Scotland, published in 1851, I came across this passage:[1] "Dr. Wayland has rendered it exceedingly probable—I may say, has almost demonstrated—that the cause of the falling off in the number of students in the New England universities is not the expense incurred, but the inadequacy, in kind, of the instruction given in these institutions to meet the more pressing wants of a people advancing rapidly in all the arts of life." The interest which this reference aroused led me to search for the writings of Dr. Wayland to which Professor Johnston here alluded. In a report to the Corporation of Brown University, on "Changes in the System of Collegiate Education," printed in 1850, I find that distinguished educator and great master of moral philosophy discussing the courses of study most beneficial to the community in a spirit so admirable, with a freedom from prejudice so remarkable, with a breadth of comprehension so rarely attained, that I am sure it will deeply interest you to hear his words, even at some length.

That which prompted President Wayland to this investigation was the very striking fact that—as you will

[1] Vol. I., p. 475 (American edition).—Ed.

now be surprised to hear—the number of college students had for a long time not only failed to keep pace with the growth of wealth and population, but had even declined. Taking the twelve colleges and universities which then formed the New England system, Dr. Wayland found that, while the average attendance for the five-year period 1840--44 had been 2063, the number had sunk for the period 1845--49 to 2000, while for the year 1850 it was only 1884. Yet during this time there had been a great increase of endowments and of annual grants for reducing tuition, and even for making it free to many classes of students. Upon this remarkable showing President Wayland dwells with much emphasis. "It would seem," he says, "from such facts as these, that our present system of collegiate education is not accomplishing the purposes intended. . . Our colleges are not filled, because we do not furnish the education desired by the people. . . We have produced an article for which the demand is diminishing. We sell it at less than cost, and the deficiency is made up by charity. We give it away; and still the demand diminishes."

Tracing this effect back to its cause, Dr. Wayland found in the curriculum of the American colleges which then existed a grave lack of adaptation to the needs of the community. "We have," he says, "in this country one hundred and twenty colleges, forty-two theological seminaries, and forty-seven law schools, and we have not a single institution designed to furnish the agriculturist, the manufacturer, the mechanic, or the

merchant with the education that will prepare him for the profession to which his life is to be devoted."

This failure of the educational institutions of the country to meet the real needs of the people was then, as Dr. Wayland conceived it, becoming ever more and more painfully felt. "With the present century," he says, "a new era dawned upon the world. A host of new sciences arose, all holding important relations to the progress of civilization. Here was a whole people in an entirely novel position. Almost the whole nation was able to read. Mind had been quickened to intense energy by the events of the Revolution. The spirit of self-reliance had gained strength by the result of that contest. A country rich in every form of capability had just come into their possession. Its wealth was inexhaustible, and its adaptation to the production of most of the great staples of commerce unsurpassed. All that was needed in order to develop its resources was well-directed labor. But labor can only be skillfully directed by science; and the sciences now coming into notice were precisely those which the condition of such a country rendered indispensable to success.

"That such a people could be satisfied with the teaching of Greek, Latin, and the elements of mathematics, was plainly impossible. Lands were to be surveyed, roads to be constructed, ships to be built and navigated, soils of every kind, and under every variety of climate, were to be cultivated, manufactures were to be established which must soon come into competition with

those of more advanced nations; and, in a word, all the means which science has provided to aid the progress of civilization must be employed if this youthful republic would place itself abreast of the empires of Europe."

"The moral conditions being equal," Dr. Wayland remarks in another place, "the progress of a nation in wealth, happiness, and refinement is measured by the universality of its knowledge of the laws of nature and its skill in adapting these laws to the purposes of man. Civilization is advancing; and it can only advance in the line of the useful arts. It is, therefore, of the greatest national importance to spread broadcast over the community that knowledge by which alone the useful arts can be multiplied and perfected. Every producer who labors in his art scientifically is the best of all experimenters; and he is, of all men, the most likely, by discovery, to add to our knowledge of the laws of nature. He is, also, specially the individual most likely to invent the means by which those laws shall be subjected to the service of man. Of the truth of these remarks everyone must be convinced who will observe the success to which any artisan arrives, who, fortunately, by his own efforts (for at present he could do it in no other way), has attained to a knowledge of the principles which govern the process in which he is employed.

"Suppose that since the Revolution as much capital and talent had been employed in diffusing among all classes of society the knowledge of which every class stands in need, as has been employed in inculcating the

knowledge needed in preparation for the professions, is it possible to estimate the benefits which would have been conferred upon our country? The untold millions that have been wasted by ignorance would have been now actively employed in production. A knowledge universally diffused of the laws of vegetation might have doubled our annual agricultural products. Probably no country on earth can boast of as intelligent a class of mechanics and manufacturers as our own. Had a knowledge of principles been generally diffused among them we should have already outstripped Europe in all those arts which increase the comforts or multiply the refinements of human life. Perhaps in the earlier history of our country such knowledge would not have been adequately appreciated. That period, however, has now passed away. An impulse has been given to common-school education which cannot but render every man definitely sensible of his wants, and consequently eager to supply them. The time, then, would seem to have arrived when our institutions of learning are called upon to place themselves in harmony with the advanced and rapidly-advancing condition of society."

Four years later—namely, in 1854—Dr. Wayland delivered an address at Union College, on the fiftieth anniversary of the presidency of Eliphalet Nott, in which he took up again the question of the studies which should be pursued in colleges, and advanced distinctly from his position of 1850. On the former occasion the main weight of his argument had been, first,

that the colleges needed the new subjects of study as a means of saving themselves from decline in influence and in numbers; secondly, that the country needed to have the colleges take up these subjects, in order that its industries might be prosecuted and its resources developed with skill and scientific knowledge. In the Union College address President Wayland asserted, with great emphasis, his conviction, not only that the new subjects of study were, if not of peculiar educational virtue, at the least equally well entitled to be recognized and respected as appropriate means for the development of mind and the molding of character; but, also, that the union of the two classes of subjects in our colleges was essential to secure the best effect of either, the two supplementing and reinforcing each other. Strongly repudiating the traditional idea that there are two kinds of knowledge: "one necessary for the attainment of our means of happiness, but incapable of nourishing and strengthening the soul; and the other tending to self-culture, but leading to no single practicable advantage," President Wayland advanced boldly to the position that the cultivation of the natural and physical sciences, both by themselves and with direct reference to their social and industrial uses, was to be regarded as essential to the completion of the college curriculum, so that the tastes, the aptitudes, and the intellectual abilities of each pupil might find the most congenial field for study and research. Time will not permit me to quote from Dr. Wayland's address on this point. It is the less impor-

tant because all which Dr. Wayland, in defiance of the traditional opinions of the day, then claimed for scientific and technical studies and exercises, has since been fully conceded, and has, indeed, furnished the reason for sweeping changes in the curriculum, and even in the entrance requirements, of the classical colleges. When we see the oldest university of America conferring its degree upon those who have never had an hour of either Latin or Greek within its walls, and even dropping Greek from its list of positive entrance requirements, we get a measure of the enormous advance in educational philosophy which has taken place since President Wayland dared to challenge the opinion, then universally held by the teachers and governors of American colleges and universities, that the classics were absolutely essential to liberal culture and that no one could be called a well-educated man without them.

Truly remarkable as were these words of the illustrious president of Brown University, in that stage of our industrial development, Dr. Wayland was yet rather a prophet than a pioneer. During the decade which followed, there occurred a considerable extension of studies in science, especially in natural science, in his own university and in many of the colleges of the traditional type; but the creation of the modern school of science and technology was yet to come. A few purely technical schools had, indeed, been already brought into existence. The Rensselaer Polytechnic Institute at Troy had been founded as early as 1824, though its

actual work was for some years delayed. About 1846–47, the Scientific Department of Yale and the Lawrence Scientific School of Harvard came into existence; and the University of Michigan took on an engineering department. These were, however, as we must now view them, rather technical than educational in their plan and purpose. They aimed to give to their small bodies of students the special training needed to equip them for practical work as engineers or chemists. They did not assume responsibility for the general education of their pupils. They were not colleges, in the sense in which the modern scientific and technical school is a college. Even with this limitation, these schools did a work, though necessarily on a very small scale, in the development of American arts and industries, which deserves most cordial recognition. One cannot read the roll of the early graduates of the Rensselaer Institute, for example, without admiration. But it was reserved for the period of the great Civil War, and the years immediately succeeding, to witness the rapid development of the modern college of the sciences and the useful arts. How far this marvelous growth of institutions adapted to the requirements of modern life was due to the war itself, working a tremendous incitement of the national ideals, ambitions, and aspirations; how far it was due to the stage of industrial development which had been reached in the peaceful progress of the nation, it would not be profitable to speculate. Certain it is that our people, in their eager exploitation of the natural re-

sources of the continent, had attained a condition where it became absolutely necessary that the enterprises into which their labor and capital were to be put should be organized and directed with much more of skill and of scientific knowledge than had been applied to their early efforts at manufacture and transportation. The larger scale on which the operations of trade and production were to be carried on, the ever-increasing possibilities of business, the rapidly intensifying severity of competition, the quickening of communication, had created an urgent want for greater technical skill and more highly trained intelligence. The old wasteful ways of dealing with materials, the rule-of-thumb methods of construction, the haphazard administration, which characterized our earlier industrial efforts, could not have been continued without greatly retarding the national development, if not without irreparable loss in the result. In a sense, and in a high sense, the scientific and technical school came because the time for it had come. Nevertheless, it is to be confessed, or rather, it is to be gratefully admitted, that the promptness and the fullness by which these new needs of the age were met were largely due to remarkable prescience and grasp of fundamental principles on the part of a few men, statesmen, scholars, or the enlightened possessors of great fortunes, rather than to popular appreciation of them. Ever since 1857, Professor William Barton Rogers, formerly of the University of Virginia and then of Boston, had been urging upon the citizens and the legislators of Massachusetts

his plans for the foundation of a comprehensive school of science and technology.[1] On April 10, 1861, four days before the firing on Sumter, the Legislature of Massachusetts gave effect to these plans by the incorporation of such an institution, of which Dr. Rogers became the first president. In the subsequent development of this, the first separate and complete college of the modern type, the plans of its great founder were carried out with scarcely an appreciable modification. Even to-day, thirty years later, with twelve hundred students, one hundred and fifty teachers, and a group of large buildings crowded with powerful and delicate enginery, machinery, and apparatus, there is scarcely a feature which did not clearly appear in the memorial that Dr. Rogers addressed to the Massachusetts Legislature in 1857. At New Haven, that prince of public benefactors, Joseph E. Sheffield, in a noble and enlightened public spirit, provided the means by which the small and feeble scientific department of Yale became the important, and,—though nominally attached to the University,—the substantially distinct and independent college of science which will bear the name of its founder down to remotest ages. Congress, too, under the leadership of Senator Morrill, of Vermont, by an Act of the year 1862, made liberal grants of public lands for the endowment, in each state and territory, of at least one college, which, though, in the public estimation at least, primarily intended for the encouragement

[1] See *Life and Letters of William Barton Rogers*; 2 v., Boston, 1897.

of agriculture, was yet to be charged with the development of the mechanic arts. Subsequent Acts of Congress have provided for still further grants to the colleges established under the Act of 1862 and for the endowment of agricultural experiment stations.

It is not needful to tell here the story of the rapid development of the modern college in America. To-day more than one hundred institutions, separate colleges or departments of universities, are offering the instruction in applied science which, less than forty years ago, was given, upon a small scale, in the few schools or departments of universities that I have named. The students of these schools, even their yearly graduates, are numbered by the thousand. What the new colleges have done for the arts and industries of the United States time will fail to tell. Not a branch of industry, not a transportation line in all the land, but has profited by the work of instruction and investigation carried on in them. There are to-day large manufactories whose entire profit is derived from a single one of the waste products which formerly found their way down the canals into the river, or were thrown unregarded into useless heaps behind the works. It is not extravagant to say that much of the industrial history of our time would never have been written but for the schools of applied science, because the things we are now proud to record would then not have taken place.

It is not, however, of the industrial and strictly tech-

nical, but of the proper educational work of these institutions that I desire to speak at this time. The modern schools of science and technology differ from the few which antedated the war in that, speaking generally, they assume responsibility for the intellectual development of their pupils, using the technical applications of science, not merely, or even mainly, with reference to their subsequent industrial uses, but with reference to their effect in the training of mind and in the molding of character. It is unquestionably true that some of these institutions, in their zeal for results immediately useful, at first made their courses too narrow and neglected those liberal studies and exercises which are essential to any complete and harmonious scheme of education. In instances, this error has already been corrected; and the tendency is now in the direction of putting these institutions in line with the best results of pedagogical thinking and experience. I do not hesitate to say that the product of these schools, in mind and manhood, in intellect and character, is not a whit inferior, in essential worth, to that of the traditional colleges. Altogether, in addition to what may be claimed for these institutions in the way of promoting the industrial development of the nation, we may safely assert that they have come to form a most important part of the proper educational system of the country; that they are doing a work in the intellectual and moral development of our people, and are making a contribution to the manhood and citizenship of the country which

is not surpassed, if indeed it be equaled, by that of the classical colleges. [Here follows substantially what appears in the address on *The Rise and Importance of Applied Science in American Education*, p. 21 *et seq.*, *ante.*]

During the past few years the older colleges have, indeed, been enriching and diversifying their curriculums by the introduction and extension of science study, at the expense of exercises which they once declared absolutely essential to a liberal education; but we still hold that in the technical applications of the sciences the new colleges have an agency and instrumentality of special educational efficiency. The earnestness of study, the directness and continuity of attention, the zeal and enthusiasm of work, which arise from the immediate contemplation and pursuit of useful arts, do not merely secure a more perfect mastery of the principles of science; they of themselves constitute an educational force which every teacher in such a school recognizes with delight, but which, in colleges of the old type, generally characterizes only the gifted scholar. To the sincerity of purpose and the intellectual honesty which are bred in the laboratory of chemistry, physics, and mechanics, in marked contrast to the dangerous tendencies to plausibility, sophistry, and self-delusion which insidiously beset the pursuit of philosophy, dialectics, and rhetoric, is added, in the school of technology, a strong and almost overpowering impulse toward study and research, which has already, in spite of traditional

prejudices, caused these institutions to be recognized as of the highest educational character by many of the best thinkers and teachers of our land.

Such was the origin of the modern school of science and technology in the United States. In his most radical mood, President Wayland contemplated no such development. Indeed, it was of the essence of his argument that the work he proposed should be done by existing colleges of the traditional type. One of his pleas for the prompt acceptance of this mission was that, otherwise, institutions would come into being to do the work which the colleges declined, thus, according to his prognostication, increasing the competition for students, already too severe, and still further subdividing the body of possible scholars. In the report from which I have quoted, President Wayland particularly referred to incipient movements, both in Massachusetts and in New York, for the establishment of agricultural colleges. It was this which he desired to see the existing colleges head off by enlarging, enriching, and diversifying their curriculum, so as to provide for the many and varied needs of modern life.

We may hold that the separate and distinct schools of science and technology were brought into existence by the tardiness and reluctance of the teachers and governors of the old-fashioned colleges, in modifying their courses of study to suit the conditions of the age; or that it was in the nature of the case that this should come about, and that, no matter how promptly and how liber-

ally the colleges might have introduced, between 1850 and 1860, the sciences into their curriculum, or how earnestly and intelligently they might have sought to adapt their instruction to the wants of the time, the new colleges would still have come into being. In either case we have to note the striking and significant fact that the anticipated effect which President Wayland so much deprecated, of still further increasing a competition already too severe, and still further dividing up a patronage already too small, has not followed. On the contrary, while the new schools and institutions have exhibited a wonderful growth, and have done an educational work which, alike as to quantity and quality, has been most remarkable, the older colleges have not suffered in the least from their competition. Adapting themselves to the changed conditions, relaxing much of the severity with which certain particular studies were once insisted upon as of the very essentials of a liberal education, freely introducing courses in pure science, they have not only much more than held their own in numbers, during the past thirty years, but have largely increased both the range of their work and the degree of their educational efficiency.

Such a result, though paradoxical, contains no deep mystery. Profound and sagacious as President Wayland was, his anxiety lest a new type of school should arise to diminish the attendance upon the existing colleges shows that there was at least one law of social and industrial economy which he had not apprehended.

What needs to be said is, not that the new colleges failed to cut into the patronage of the older institutions, as something which it was reasonably to be expected they would do; but that the appearance of the new type of schools, appealing to new interests, using new methods, applying themselves to objects not before considered, so stimulated and strengthened the total educational impulse throughout the country as not only to secure for themselves an ample support and patronage, but also to give fresh life and activity to the older colleges, which had sunk into routine, tradition, and imitation. I will not say that the men who founded the new colleges saved the old—that might be claiming too much; but I believe that no student of American education will question that the new colleges had an immense influence in quickening the life of the old and in promoting the searching reforms from within which render them today so much more active and efficient than in any previous stage of their existence.

In social and industrial economy there is no greater fallacy than that of a predetermined dividend. As an economist, I have all my life been fighting it in the department of labor and wages. Here, in the educational history of the past fifty years, we get another striking view of the fallacy of this notion. It is ordinarily said that demand creates supply; and this is true throughout the lower ranges of life. In the matter of food and fuel and clothing, and, indeed, in regard to all things where human wants have become fixed and settled, we have no

occasion to worry ourselves about the supply. Demand will take care of that. Civilization may be trusted to hold on to whatever advances it has once fully and fairly made, whether in material or in other directions. The conscious wants of humanity will suffice to secure the due supply without any organized public or private effort other than that originating in personal interest. But in all things high and fine, and generally, also, in every advance which material civilization is to make, there must be a better intelligence than that of the market, which shall apprehend not what men want, but what they ought to want. There must be disinterested efforts on the part of the natural leaders of society which shall secure, at whatever sacrifice, such a demonstration of the merits and advantages of the yet unknown thing, such a supply of the new good, as shall create the demand for it. It will not be until that want has been fairly and fully wrought into the public consciousness, that the supply may thereafter be left to take care of itself. The American schools of science and technology illustrate in an eminent degree the law of human progress which has just been stated. They themselves came into existence, not in obedience to a conscious popular demand for them, but by reason of the foresight, the unselfish devotion, and the strenuous self-sacrificing endeavors of a few men who were in advance of their times; and, having thus come into existence, they have, through their whole course, freely illustrated the principle that, in certain classes of things, supply must create demand. It

was by the graduation from colleges of science and technology of men thoroughly prepared to do the work in chemistry, physics, mechanics, and engineering, which the country needed to have done, that the country came to be conscious of that need. We have to-day thousands of chemists, electricians, mechanicians, and engineers engaged in developing the marvelous natural resources of our country and in carrying on its giant industries. Not because there was, thirty, twenty, or ten years ago, any such conscious demand for those services as would have justified so many young men in preparing themselves for that work, but because the schools of science and technology began to send out, first, scores; then, hundreds; and afterwards, thousands of well educated and thoroughly trained young men, who, finding their way—it might even be said forcing their way—into employment here, there, and anywhere, at whatever scale of initial compensation, in whatever capacity, —sometimes, in the beginning, doing the work of day laborers,—demonstrated to reluctant and prejudiced minds their capability of usefulness. In this case as in so many others, demand has been created by first furnishing the supply, by showing what young men properly educated and highly trained can do in organizing and directing the forces of American industry.

So great a change, as has thus been traced, among the higher institutions of learning in the United States could not take place without producing very marked effects upon the scheme of secondary education, and even upon

the courses of the grammar school. The usefulness of the college of science and technology, both from the practical and from the educational point of view, has passed beyond dispute. Not only its own work, but the large concessions in the direction of scientific study which are so rapidly being made by the classical colleges, render it impossible for any responsible person to denounce, or even to deprecate, the movement which has been in such rapid progress during the past thirty years, though criticism of general methods and of special exercises will long be appropriate and welcome. But the work of modernizing the secondary school, so that it shall more closely meet present needs, has yet to be accomplished. Much has already been done; but nearly all that has been done remains tentative, both in theory and in practice. The subject remains to be thought out and wrought out; more, perhaps, to be wrought out, by trial and experiment, than to be thought out.

One thing, at least, I think we may say. The so-called mechanic arts high school, whether supported by the city or maintained by private endowment, has already assumed, in some degree, its definite shape. Doubtless there will be changes in its curriculum. The proportions in which shopwork, drawing, and geometry shall be joined, in the scheme of instruction, with grammar, history, the modern languages, and geography, have as yet been only rudely determined; while within each of the newer courses of study a great deal has to be learned regarding the most effective methods to be

employed. But enough has already been shown fully to convince my own mind that this addition to the American system of education is to be a permanent and important one. Moreover, I feel confident that we shall witness here another exemplification of the principle which was noted in regard to the effect upon the attendance of the older colleges produced by the establishment of the newer. I believe it will appear that the mechanic arts high schools do not, in the large result, take at all from the existing classical and English high schools. On the contrary, I hope to see the new schools not only create a constituency of their own, but even communicate an impulse throughout the whole high school system not unlike that communicated to the whole college system by the colleges of science and technology. If this result shall be attained it will be most fortunate. The present condition of things, where in some communities not more than ten, and in other communities not more than five, per cent. of the pupils of the grammar schools go forward into the secondary schools, is not one to be viewed with complacency. It certainly seems as if the high schools had fallen out of an intimate adaptation to the wants of modern life, into the stage of routine, tradition, and imitation, as did the colleges of the United States before the period to which President Wayland's report related. I cannot but cherish the hope that not only will the mechanic arts high schools gather within their walls tens of thousands of youth whose parents would otherwise have taken them out of

school, at fourteen years of age, to begin their work in life without any adequate training or equipment, but that the very establishment of these schools will have an effect largely to increase the attendance upon the traditional high school. That the study of chemistry and physics will more and more extend through the several years of the high school, whether the Latin school, or the English high school, or the mechanic arts high school, I regard as certain. In addition to the remarkable virtue which these studies possess from a purely educational point of view, in addition to all the advantages which attend their pursuit with reference to higher work, whether in science or in technology, there is one important consideration which favors their adoption as no inconsiderable part of the curriculum of all secondary schools. This consideration lies in the fact that, pedagogically speaking, elementary chemistry and elementary physics are, perhaps, the two subjects which are most easily taught; which, with moderate attention and fidelity, are best taught, even though the teacher be not gifted.

In a certain sense and to a considerable degree they teach themselves. I am not unmindful of the great differences which exist in the progress of the youthful pupil in chemistry or physics, according as his teacher is one who possesses natural and acquired gifts of instruction, or is one whose chief qualification is that he, himself, knows his subject well. But I still hold to the opinion that of all the subjects of instruction known to

the high school curriculum, these are the two which are least dependent upon rare powers of instruction in the teacher. Compare them, in this respect, with Latin, or Greek, or history, or even, I may say, with geography. It may not be flattering to the teaching profession to give prominence to such a consideration; but we are bound to recognize the fact that, with a very large majority of the members of that profession, as they are at present educated, equipped, and called into service, the main qualification which we see in them is that they fairly well understand the subjects they are to teach and are earnestly desirous of doing justice to their pupils. In such a situation it is no small advantage that in so large a degree chemistry and physics do their own teaching, drawing pupils on, naturally and almost irresistibly, from experiment to experiment, from one stage of attainment to another.

The problem of introducing science studies and practical exercises into the grammar schools is far more difficult. It is a matter in respect to which we have made very little progress during the past ten or fifteen years, although much thought and attention have been given to the subject by some of the most accomplished educators of our country. I shall not attempt to deal with the question of methods at this time. The subject is too large and complicated. Nor do I feel myself qualified to offer suggestions of value toward the solution of the problem. I shall confine myself to presenting the considerations which draw my own mind to the conclusion

that an extensive introduction of the objective study of concrete things and of hand and tool work of one kind or another, into all the grades of the grammar school, is of great importance, both for the fullest and happiest development of the powers of the pupils and for the best social and industrial results in their after-life.

[President Walker then proceeds to develop these considerations upon lines similar to those followed in the address upon *Industrial Education.* See pp. 141 to 145 *infra.*]

I have hurriedly reviewed the several grades of schools as they are generally organized under our American system of education—the college, the high school, and the grammar school. But the present occasion calls sharply to our attention the coming into existence, during the past few years, of a new type of school, which is out of the ordinary line of ascent; which does not confine itself to a definite place in the educational order, but seeks objects of its own, and is at liberty to use all the agencies, instrumentalities, and methods which are appropriate thereto. The schools referred to are as yet few in number and are still in the experimental stage; but every believer in the new education must regard their establishment with great satisfaction, looking to them, not only for much positive good in the education and life preparation of their own pupils, but also for much that will be valuable in the way of suggestion, both as to subjects of study and as to the most effective methods of presenting such subjects.

As examples of these new institutions may be cited the Pratt Institute of Brooklyn, the Drexel Institute of Philadelphia, and that whose foundation we celebrate to-day. Each of these is the result of munificent benefactions on the part of wealthy individuals seeking the public good. Each comes into the field with a "free hand," bound by no traditions; perfectly at liberty to seek the best, from whatever source; to prove all things and to hold fast to that which is found good; ready, eager, and anxious to occupy every part of the ground which has been overlooked or neglected in the existing system of instruction, and to meet every educational want which has been left unsatisfied. These schools call themselves neither preparatory schools, nor high schools, nor colleges. They recognize no responsibility to the established order. They purpose to make themselves; not to be fitted into a place in a system. It follows from this that much of their work is at present experimental; that their schemes are large and somewhat vague; and that their ultimate form is not easy to conjecture. Herein is one of the chief reasons for the hope of their future usefulness. Every friend of education must watch their course with interest, and study their programmes and their catalogues to see from time to time what they shall undertake and what they shall drop; in which direction they shall grow and in which other directions they shall, if not decline, at least not progress or not progress rapidly.

The advantages which I am sanguine enough to an-

ticipate from the establishment of schools of the new type are three:

First, as the result of their freedom from obligation to the general system of education, they not only will be at liberty, but they will be strongly impelled to search out those real needs of the American people in the matter of education which are at present unsupplied. We must not presume that such needs, even of the most imperative character, may not exist. The long paragraphs from the report of Dr. Wayland, in 1850, strikingly show how far a system of public instruction, long established, highly appreciated, even venerated and regarded as above criticism, may be grossly inadequate to the demands of a given time. In the present stage of social and industrial change, change almost bewildering in the rapidity of its movement and in the extent of the fields over which it is taking place, it is most reasonable to believe that great gaps exist between the public needs and the accomplished or even attempted supply of those needs by the existing institutions of learning, even including the schools of science and technology, as developed during the past thirty years. If such be the case, and it would be most unreasonable to deny that it is highly probable, the "free hand" of which I have spoken, in connection with the schools of the type we are considering, must be an important condition of successful effort to supplement the American system of instruction. To "cut and fit and try on" is their special mission; and no one who takes this view of the subject

can fail to regard it as most undesirable that the governors and teachers of these schools should allow them to be early crystallized into definite forms. It is essential to this function, as I conceive it, that they should remain largely in a state of flux; open to all impressions; mobile under all influences; not too soon assuming that they have found their ultimate resting place and have taken on their distinctive character.

Secondly, it seems to me reasonable that we should look to the schools of the new type for continuous experimentation in regard to specific courses of instruction and technical means and methods of teaching, the benefit of which shall be chiefly acquired by other institutions. The same "free hand" which enables these schools to take up any line of work which seems at present to be inadequately performed, to enter any field which appears not to be covered by existing agencies, will enable them to exercise the largest liberty and activity in developing the details of each and every subject to which they may apply themselves. It scarcely needs to be said that such freedom brings with it peculiar dangers. A school which belongs to a system and is fitted into a place; which, at the one end, takes its pupils from lower schools, and at the other delivers its graduates to higher institutions, subject to their examination and criticism, cannot go far or rapidly astray. But a school which has entire liberty to choose its own field of work and to adapt its own methods, to cut and fit and try on, must depend upon its own boards of instruction

and management properly to temper enterprise, courage, and intellectual curiosity with wholesome conservatism and sound practical sense.

Thirdly, the last special advantage which I will indicate,—though doubtless there are others,—as reasonably to be expected from the establishment of schools of the new type, is the training of teachers to conduct the practical studies and exercises so rapidly making their way into the secondary schools of our land, and which may be expected soon to be introduced into our superior grammar schools. I am not ignorant of the fact that a few of the traditional normal schools of our country have shown great liberality and much intelligence in undertaking to prepare their pupils to give instruction in these branches. I recognize the excellent work of the New York Normal School in undertaking to prepare teachers of the domestic and the mechanic arts for the public schools. But all that can be done in this direction will not be too much. Indeed, the extension of the new subjects of instruction has, from the first, been greatly hampered by the lack of competent instructors. Moreover, I cannot but think that from schools of this type will go forth many teachers better prepared to contribute to the development of the theory and practice of the new profession than the graduates of the traditional normal school with a little of the mechanic arts added, or even than the graduates of a normal school specifically and solely directed to the training of teachers for that work.

With these words I close this already too long protracted address. I congratulate the citizens of Potsdam that their home has been made the seat of an institution of this character, established by the munificence of three noble women who recognize the obligation which wealth imposes, and whose eyes have been anointed to see that the best thing about money is its power of doing good to others. I congratulate the governors and teachers of this Institute upon the opportunities which have been opened to them to make a special and important contribution, not only to the welfare of hundreds and thousands of future pupils of their own, but to the philosophy of education throughout our land. Just as the early schools of technology gave to the classical colleges the laboratory of general physics and the laboratory of general chemistry, now regarded as essential and even indispensable in every school of liberal learning, so here at Potsdam may be developed and wrought out agents and instrumentalities of instruction, courses of study, methods of teaching, which in another generation shall be applied to the training of millions of American youth.

THE PROBLEM OF "ENGLISH" IN SCHOOLS OF TECHNOLOGY

I. An Extract from the Report of the President of the Massachusetts Institute of Technology for the Year 1890.

II. A Communication to the Department of English of the Massachusetts Institute of Technology.

THE PROBLEM OF "ENGLISH" IN SCHOOLS OF TECHNOLOGY.

I.

The problem of giving instruction in English, to the best effect, to students of scientific and technical schools, is a very interesting one. The teacher who shall solve it will make a contribution to the philosophy of education which will be of great value, inasmuch as the number of these schools is large, and is rapidly increasing. The instruction given in English in the classical colleges is, by general admission, very unsatisfactory; but, at least, it stands related to the fact that the pupils have a comparatively large vocabulary, derived from long-continued work in language; that they have made a special study of etymology; that they have become familiar with the figures of rhetoric through the Latin and the Greek, and that they have for years been exercised upon subtile distinctions, alike in language-study and in philosophy. Directly to introduce the methods of English instruction, as practiced in our colleges, into a scientific school, would be to invite failure. Here the pupils have had little language-study; they are generally unfamiliar with the etymology of the words they use; they have little ingenuity in expression, and, indeed, but slight disposition to make much of expression. For

pupils of this class, the methods that would be proper and useful in a college must be modified in no inconsiderable degree if the highest success is to be obtained.

I have spoken of the deficiencies of the student of science, as compared with the student of the classics, of metaphysics, and of rhetoric, so far as the familiar college work in English is concerned. But it must not be thought that the account is all on one side. The scientific student has, to compensate for these deficiencies, certain mental qualities which may be made use of to good effect in training him to use his own language in statement, in narrative, in argument, or in the writing of personal letters and professional reports. The problem in pedagogics which I spoke of has reference to the best means of making use of those qualities in the teaching of English.

The student of natural and physical science has certain deficiencies in language which have been fairly acknowledged; but he has an immense advantage in a far greater clearness and vividness in the formation of mental images, and a much stronger grasp upon his conceptions. Trained, day by day and year by year, in the objective study of concrete things, he sees nothing vaguely; the images he forms are definite and distinct; what he knows, he knows perfectly. If fine writing be the end in view, these mental characteristics may or may not be advantageous; but for the purposes of simple, straightforward, manly expression, whether in description, in exposition, in narrative, in argument, or

in business correspondence, they are a source of great power. Such a student will still need much study and practice in the use of language to save him from committing numberless solecisms and to give him the completest use of his own powers of expression; but he is, taken altogether, a student of English not a whit less promising than his fellow in the classical college. Nay, the advantage indicated extends from the thinking to the speaking or the writing, since every word which is seen to contain a physical image, as so many words do, and indeed as nearly all words in their beginning did, means more to a student of science than to a student of language, literature, and philosophy.

II.

The problem of dealing with college students who are awkward, weak, or inaccurate—one, or it may be all of these—in "English," that is, in conversation, in composition, in penmanship, and in spelling, is a difficult one in classical colleges. It is still more so in a school like this [the Massachusetts Institute of Technology], where the amount of time and effort which, at the best, can be devoted to instruction in these branches is very closely restricted.

To begin with, it may be said that the sort of teaching which alone can help this class of students, which alone can save them from grave injury to their social and professional character and standing, does not really belong to the college. It is in the earlier schools—if in

school at all—that the pupil should acquire ease, directness, simplicity, and accuracy of expression—whether in statement or in illustration, whether in narrative or in argument. If a child passes from the grammar school into the high school slow, blundering, and awkward in expression, heedless in his writing, inaccurate in spelling, he can, indeed, be helped in a measure to overcome his defects and infirmities, by a great deal of attention and effort on the part of his teachers; but it will require—let us say—three times as much of that effort and attention to effect any degree of improvement in these particulars as would have been needed to bring about the same result in the grammar school. And, again, if the pupil goes on from the high school into the college still suffering from defects and infirmities regarding expression, it will require—again let us say—three times as much effort and attention on the part of his teacher there to give him anything like adequate power in arranging his ideas with reference to their expression, in controlling his thoughts while passing down the flume to the wheel, and in uttering them easily, clearly, connectedly, accurately, as would have been required to effect this training in the high school. In other words, when a college is called upon to teach and to train a pupil so that he shall not prejudice himself through all the rest of his life, socially and professionally, by blundering, awkward, obscure, and inaccurate expression, it is in fact required to do something which does not belong to the college at all, and the difficulties

of which have been aggravated many-fold by neglect in earlier years. For a college to impart the ability to write simple, plain, straightforward, agreeable English is as much more difficult than would have been the same task in respect to the same pupil in the grammar school, as is the correction of a grievous fault in the limbs of a mature man, compared with the correction of the same fault in the limbs of a growing child.

But the fact that this kind of work does not properly belong to the college at all constitutes no reason why, in the face of neglect by the lower schools, the college should not take it up, for the sake of otherwise good and successful scholars who have the promise of professional and social usefulness. The faculty of a school like our own cannot content themselves with saying that this pupil or that ought to have acquired his "English" before coming hither; and that they will not do anything to meet the lamentable fact that, in all matters concerning the arrangement and expression of his thoughts for writing or for speaking, he is as woeful a case of deformity, obliquity, and perversion as ever was brought into the operating room of a hospital. Little as that task is properly chargeable upon the teachers of an institution of such a grade, it is still true that many deserving young men who, as students of science and in technical work, are strong, clear-headed, and sensible, and who may confidently be relied upon to do excellent work in a scientific profession, will suffer deep and irreparable injury by reason of deficiencies and mistakes

in expression and representation, unless they are helped in this matter. Not only will they fail to do justice to their scientific conceptions, to the results of their practical investigations, to the validity of their economic proposals, but they will be at a continual disadvantage in the view of their employers and in the public mind, in comparison with men who, as thinkers or workers, may be miles below them. It is true, and we have to accept the fact, that a monstrously disproportionate value is attached to certain matters of expression, as for example, spelling. A man may be learned, fertile in ideas, rich in imagery, even eloquent in speech, and yet a mistake in spelling will make him an object of ridicule by men who have not a hundredth part his accomplishments and acquirements. A man may not know three facts in human history, much less have an idea regarding any one of them, and yet not be so much at a disadvantage in consequence, as would a learned and able scholar and thinker who sometimes misspelled a word. Now, it is not the business of the colleges to convert public opinion to a true relative appreciation of spelling in comparison with other gifts and accomplishments, but to accept the opinion and present view of society on that point, and, by such opportunities as they may have at command, to endeavor to save otherwise promising pupils from a grave disadvantage, both professional and social.

What, then, may the technical and scientific school, where only a small portion of time can possibly be given to English studies, do for those students who have come

up from the high schools prepared in the main to carry on their college work satisfactorily, perhaps with marked success, and yet grossly deficient and defective in the matter of which we have been speaking? We will assume that some portion of time is given in the college to the instruction of the whole body of students in English. Shall the view which has been presented above of the very great importance of this matter to the less fortunate members of the class—English-wise—and the acknowledgment by the faculty of a certain degree of responsibility in the case, lead to an effort to increase the time devoted to English by all the students of the successive classes? or shall those who are notably deficient in the respects indicated be constituted a separate body, for additional, and as far as possible, individual treatment? As to the first suggestion, it may at once be said that a three-fold increase of the time now devoted at the Institute of Technology to class-work in English would not meet the case; and, of course, any such increase is out of the question. Indeed, I am much disposed to think that no amount of additional class-work would have the result, in any large degree, of curing the defects and supplying the deficiencies of which we have been speaking. For students suffering from this infirmity, class-room work hardly hits the mark at all, though it may be of great value to those who have a certain natural competency in English and have been well trained and under good influences, in this respect, at home and in the preparatory schools. Even if it were possible

largely to increase the amount of time given to English work, it would be better to adopt the alternative suggestion and to look upon all students who are notably deficient in this particular as constituting a class for distinct and, as far as possible, individual treatment. Without going into the philosophy of the subject, I beg to be permitted to outline a scheme which, it seems to me, might be adopted to good advantage by the English department, with the sanction of the faculty.

(1) In the first place, there should be made up during the first term in the English department, as the result of entrance examinations, of department work in composition, and of the inspection of matter written in the course of the students' ordinary work in other departments, a "black list," though not a list so called, on which should be found the names of all students who show marked deficiency in the respects indicated. The value of such a list would greatly depend upon its being made up, not only with care, but conservatively. If students were liable to be put upon the list merely by reason of a slip or two, occurring in simple carelessness or haste, the purposes of the system would be practically defeated. Only those names should go upon the list which represent students suffering from inveterate weaknesses or disorders in thinking and writing.

(2) Each student thus put upon the list,—which I shall continue for the purposes of the present discussion to call the "black list," though of course such a title would be impossible in the actual working of the scheme,

—should be informed by the head of the English department, in the most friendly and kindly way, that attention has been called to certain marked defects, deficiencies, and weaknesses on his English side. This communication should go on to explain how much of social and even of professional annoyance and embarrassment may be suffered from this source. The student should then be advised to give his thought seriously to the matter, trying for himself to rectify the tendency to make mistakes or to write or speak awkwardly or blunderingly. He would naturally be advised always to look over his own letters and papers after writing them—a matter in respect to which most young men are very much at fault. Certain books would perhaps be commended to him. The advantage of such a communication would be found largely in the fact that the evil tendencies referred to are due, in many cases, to thoughtlessness or carelessness. Just as hosts of boys and girls who, in the course of becoming round-shouldered and slouching in bearing and carriage, have, simply by being nagged about it by parents and brothers and sisters, been brought into almost painful uprightness and rectangularity, so many students need only to have the matter brought sharply to their attention and held strongly before it, to induce efforts on their part which would suffice to secure good results. With the formation of the "black list," and with such notices of warning and advice to the individual students concerned, I would have nothing more done during the first year, be-

yond what might come through a cordial invitation to students to consult their teachers freely.

(3) At the end of the first year, I would have the English department carefully revise the "black list," and send out to each person who had received the previous notice, one or the other of two forms of communication. In one the student might be encouraged, not too much, by the information that his work had shown improvement; but he should be advised very earnestly to make further progress in this direction, especially by reading books which have a peculiar ease and felicity of expression, and in some considerable measure, by reading such books aloud, or by hearing them read aloud by others. I am convinced that the education of the ear is too much neglected in the modern school. The other form of communication referred to might be sent to those students who had not made an appreciable degree of progress in correcting their faults or in supplying their deficiencies. This letter should be kind in tone; but it should very strongly set forth the disadvantages which the young men will inevitably suffer, both socially and professionally, unless they rid themselves of their limitations, their weaknesses, and their positive defects in the matter of writing and speaking. The communication might go on to say that this warning, given at the beginning of the summer vacation, was intended to suggest to them the importance of making strenuous efforts to that end during the three or four months following. Attendance on a summer school, if practicable, should

be recommended. Rules and prescriptions suitable to the general case of such students might be given. In the preparation of these, the teachers of English at the Institute of Technology would have an opportunity to achieve great distinction, since the field is largely virgin soil. This communication might close with the statement that, unless the course of the second year should show a marked improvement in the respect under consideration, the student would at the end be formally "conditioned" in English and would thereupon be required to take a considerable body of studies and exercises, under direction and supervision, and as a purely extra thing, without which he could not further attend as a regular student in the Institute. Such a condition, for example, might require attendance upon a summer course especially conducted for students of this class, in which attention would be principally given to weaknesses, and to defects and mistakes of expression. The condition imposed should not be a slight one, and should be remorselessly exacted. The mere fact of placing so much importance upon this matter, at the middle of the college course, would have a salutary effect in arousing the pupils' attention and interest in the matter; while some weeks of hard work under severe criticism could not fail to have a certain positive result for good, necessarily much greater in the case of some students than of others.

(4) Having done so much as has been indicated, it seems to me that the faculty of the Institute, as a body,

might thereafter regard themselves as discharged of responsibility in this matter, though the English department will, of course, continually strive to improve the character of the students' work through class exercises and individual conferences, and through criticism of papers prepared in the course of professional study. I would refuse the degree of the Institute, on account of deficiencies or defects in English, to no man who was in all other respects well qualified for a creditable professional career. I would recognize the fact that there are some persons who are deaf, dumb, and blind on this side of their minds and yet are capable of excellent work as scholars, as thinkers, and as men engaged in professional practice. All the lecturing in the world will do very little for this insoluble residue, and they must go into the world bearing this burden for life, just as they would bear a physical infirmity which was not to be cured.

Of course, all the foregoing should be only in the nature of a supplement to the unceasing efforts of the faculty of the Institute, and especially of the teachers of English, to raise the standard of the high schools, and, through them, of the grammar schools, in the respect under consideration. While, in the spirit of humanity, dealing as well as possible with the bad surgical cases sent up to college, we should see to it, so far as lies in us, that the earlier schools give orthopedic treatment in all cases of deformity or weakness, at the stage when these can be dealt with most easily and effectively.

MANUAL EDUCATION

INDUSTRIAL EDUCATION

1884

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INDUSTRIAL EDUCATION.

In the active discussion now in progress concerning Industrial Education, that term is used in such widely different senses as to require that a paper treating of this theme should begin with a definition. With a view to this, I offer the following classification of the schools which undertake what is by one person or another understood to be industrial education.

First, we have the schools of applied science and technology, whose purpose is to train the engineer, the architect, the geologist, the chemist, the metallurgist, for the work of their several professions. These schools do not aim to educate the men who are to do the manual work of modern industry. In the main, they do not even aim to educate the men who are to oversee and educate the work of others—the men, that is, who are to act as superintendents of labor. It is the function of schools of this class to train those who shall investigate the material resources of the country, and shall project operations for the development of such resources, to be carried on by bodies of labor and of capital under the direction, in the main, of persons who have received their education and training in schools of a different order, or through practical experience in the field, the shop, and the mine.

The distinction here rudely outlined between the per-

son who investigates the material resources of the country, in any direction, and organizes industrial enterprises for the exploitation of those resources, and the person who superintends and directs the labor employed in such enterprises, is not, indeed, strictly maintained; but it exists in a general way, although a tendency to employ, in increasing degree, civil, mechanical, and mining engineers, chemists, and metallurgists in administrative and executive capacities, has been observed during the past few years.

The expediency of establishing schools of the class herein indicated is no longer a matter of debate. The general government and many, if not all, of the State governments have recognized the importance of thus providing for the scientific development of our industries; and the large and increasing measure of reputation and financial success enjoyed by the Troy School of Civil Engineering, the Hoboken School of Mechanical Engineering, the Sheffield School of Civil and Mechanical Engineering, the Columbia School of Mining Engineering, the Boston Institute of Technology, with its departments of civil, mechanical, and mining engineering, the Worcester Free Institute of Industrial Science, the Chandler Scientific School and the Thayer Engineering School, both of Dartmouth College, with a score of other institutions all deserving to be named were this the immediate subject of our paper, show that the value of such institutions has passed beyond challenge or cavil.

A second and widely different class of institutions is

found in the so-called trade schools. The purpose of schools of this class is to train the actual workers in industry, and to train them, moreover, for what it is presumed will be their individual occupations in life. In the main, these schools do not aim to train the overseers and superintendents of labor, but the individual operatives. And, in general, the work of these schools assumes that the particular vocation for life of the children who enter them is already reasonably well determined.

The efforts at industrial education in the States of Europe have commonly taken this form. The trade schools of Switzerland, of Holland, and of France, are schools in which young people are taught well-defined trades, generally such as are pursued in the immediate region where the schools are established. Thus, certain trade schools in Switzerland have reference to the great watch-making industry of that country, and have it for their object to train pupils who, it is assumed, will, by almost an industrial necessity, become watchmakers.

The third class of schools, and that to which the present paper will be confined, comprises those into which manual and mechanical instruction and training are introduced in greater or less degree; not, on the one hand, to make engineers; not, on the other hand, for the purpose of training the pupil to become an operative in any particular branch of industry which it is presumed he will enter; but as a part of the general education of the scholar, with reference to the fuller and more sym-

metrical development of all his faculties and powers, and to the promotion of his success in whatever sphere of labor it shall subsequently be determined he is to enter.

It is schools of this class the establishment of which is at this time being especially urged, under the general title of Industrial Education.

In some respects, the term "industrial education" is itself an unfortunate one. The term "mechanical education" would better express the objects of those who are now advocating an important modification of our system of instruction. But the term first referred to has been so widely adopted in the discussion of this subject that it is likely to be used long after the mechanical education of our children and youth has passed the period of debate and has become incorporated in our public school system.

The distinction between the trade school and the school of the kind last indicated, will be seen, if properly contemplated, to be very marked. Not only does the trade school assume that there is a high degree of probability that the pupil will enter a definite field of labor, for which it undertakes to prepare him; but the establishment of such schools undoubtedly contributes, in an important degree, to enhance the probability of that result.

The confusion of trade education with a general mechanical education has undoubtedly engendered not a little of the prejudice which the scheme of industrial education has encountered in certain quarters within the

United States. It has been alleged that the establishment of the proposed system would be opposed to the sentiments of our people and to the genius of our institutions, inasmuch as it would assume that the children who were to receive training were born to a certain condition of life, and were destined to perform a certain industrial *rôle*. The scheme of industrial education has, therefore, been objected to as curtailing the glorious birthright of every American boy to become banker, merchant, judge, or president, as his own abilities and virtues may qualify him. It will appear, I think, in the further course of this paper, that the objection is founded upon a misapprehension; and that the adoption of the system of education under view would not only not confine the choice of the pupil as to his subsequent mode of life, but would tend to give him an even greater freedom of movement and action.

That the establishment of trade schools, in the strict sense of that term, has proved advantageous in many of the crowded communities of Europe, I entertain no doubt. When, by reason of the dense occupation of the soil and the diversification and localization of industries, the choice of young persons is, in fact, very closely limited, it is probably the part of wisdom to recognize that fact, to accept the situation, and to prepare the young as well as possible for the work which, by almost a moral necessity, they will be called to perform. That even in some communities of the United States the point has already been reached where the establishment

of trade schools by private benevolence, or even by municipal authority, might be practically advantageous, I am not disposed to deny.

In any large city whose population is chiefly, and perhaps almost wholly, occupied in some single and highly special branch of industry, the instruction of the young in the arts specially concerned in the prosecution of that industry may be deemed, not unreasonably, the dictate of practical wisdom.

Yet the position of those who have opposed industrial education on the ground that the United States have not yet reached the condition which requires or justifies the education at the public expense and under State authority, of young children, with reference to specific trades, is in the main sound and just. The proper answer to this objection is, that the system of industrial education proposed would rather enlarge than confine the subsequent choice of occupations by the children of our public schools.

The purpose sought by the advocates of so-called industrial education is the training of the eye and the hand of the pupil, and his acquisition of those elementary principles of physics and mechanics which underlie all dealings with the forces of nature and with material objects.

I have spoken of the "establishment" of schools of industrial or mechanical education. Yet, in truth, it is not so much the creation and endowment of separate schools of this character which is in view, as the gradual

conversion of all the existing schools of the land to this use, through the grafting of certain studies and exercises upon the traditional curriculum. Such conversion would involve only a slight disturbance of the structure of the existing schools; but it would require the surrender of a not inconsiderable portion of time to the new studies and exercises.

In order not to protract this paper unduly, or to provoke needless controversy, I shall on the present occasion confine my remarks to the relations of the proposed changes in public instruction to the boys of our public schools, leaving open the question whether the girls shall join in the new departure, or not.

As to the precise nature and extent of the studies and exercises which should, to this end, be incorporated in the public school curriculum, and as to the order of these exercises, much difference of opinion will doubtless be developed among those who advocate an extensive modification of the present scheme of education. The true final system, will, of course, have to be worked out through long discussion and experimentation. The following is presented as a fairly conservative programme:

Beginning with the pupil at the stage when kindergarten methods and appliances are exhausted of their efficiency, the scholar should be instructed in the elementary principles of physics and mechanics through the use of simple models and apparatus, and should become familiarized through frequent statement and illus-

tration with the fundamental conceptions of geometry. There is a deep-seated popular error as to the age at which such things as the above can advantageously be acquired. It is too often assumed that because the young child is not competent to study geometry systematically he need be taught nothing geometrical; that because it would be foolish to present to him physics and mechanics as sciences it is useless to present to him any physical or mechanical principles.

An error of like origin, which has wrought incalculable mischief, denies to the scholar the use of the symbols and methods of algebra in connection with his early essays in numbers because, forsooth, he is not as yet capable of mastering quadratics! If our children were taught to "do their sums" algebraically at eight, nine, or ten, the later parts of the algebra would have far less terror for them at fifteen, sixteen, or seventeen. And yet, from the notion that the teacher must not take up any subject which the pupil is not prepared to go through with to the end and to master scientifically, we drive our boys and girls to the most painful and absurdly roundabout methods of solving problems. The moment the child begins to "do sums" upon his slate he needs his x and y, and for lack of them he is continually driven back to "What d'ye call 'em," or "thingumbob," his unknown quantity, the object of inquiry for which he is refused a symbol—the length of the pole, John's share of the cake, the number of gallons in the cistern, or what not. The whole infant

generation, wrestling with arithmetic, seek for a sign and groan and travail together in pain for the want of it; but no sign is given them save the sign of the prophet Jonah, *the withered gourd*, fruitless endeavor, wasted strength.

To teach the so-called arithmetic of the common school without the use of the algebraic signs and notation, is in the last degree barbarous; yet it is done, almost without exception, in the case of ten millions of school children, all from the notion that they are not yet prepared to enter upon the study of algebra! Study of algebra! Algebra is a *tool*, and nothing but a tool, and, so far as equations of the first degree are concerned, it is a tool which the child needs the moment he is set to inquire in how many days Jones and Brown can do a piece of work together, if Jones could do it in ten days alone or Brown in fifteen. For an equally bad reason, many things have been withheld from school children, though these were things of which every child should be informed at the earliest possible moment, because they belong to geometry, for the systematic study of which the scholar has been held not to be prepared.

It is true that of late years, teachers, drawing doubtless their inspiration from the kindergarten, have presumed to give the geometry of the square and cube before requiring the arithmetic of square root and cube root; but this concession to common sense stands almost solitary and alone on the pages of the modern text-book. Take, for example, the conception of a plane, the most

difficult and the most important of all conceptions for the purposes of the geometer, the astronomer, the mechanician. This conception should, for subsequent success whether in geometry, in astronomy, or in mechanics, be formed in the mind of the child at the earliest possible moment, just as the notion of right should be formed in his mind years and years before he is called to the systematic study of ethics.[1] No subsequent effort can

[1] As to the question whether morality can be taught in our public schools without sectarianism, I would say that I do not see how any system of morality which undertakes to go back to an ultimate rule of right can be taught without sectarianism.

If, however, the teacher is content to begin somewhat short of that point, it seems to me perfectly practicable to give instruction in ethics without involving any sectarian issues, although it is doubtful whether this can be done without arousing sectarian spirit, inasmuch as there are certain sects or denominations which resent the omission of their own particular tenets, as itself irreligious and immoral. Of course, with such people you can do nothing. They are opposed alike to public school teaching with ethics and without ethics; and any attempt to conciliate them or buy off their opposition will be futile, and will only weaken the dignity and authority of the school system.

As to just how much may be taught without raising sectarian issues, opinions might differ widely, and I do not claim to have made a special study of this department of instruction. I should say, however, that :

1. Legal ethics may be taught without offense being properly taken by anyone, and this would cover a large part of the desirable field of teaching. Clearly, all the acts which are prescribed, or are forbidden, by the law of the land may properly be embraced in the instruction of the public schools.

2. It appears to me that utilitarian ethics may be taught in the public schools without raising sectarian issues, and without arousing the sectarian susceptibilities of any person who is not at heart opposed to the schools themselves. I mean by utilitarian ethics a system or scheme of morality which, without attempting to raise the question of the ultimate rule of right, shall accept the greatest good to the greatest number as an approximate rule for determining what is best to be done and

make up for the neglect of such fundamental conceptions in the very beginnings of education. The freedom and force with which these conceptions will be referred to and made use of in after-life, must in a very large degree depend upon the age at which they are first acquired.

They should be early implanted in the mind that they may grow with its growth and strengthen with its strength. What sort of students of literature would you have if you put off the teaching of the alphabet of letters till fourteen or fifteen or sixteen, as you in fact put off the teaching of the alphabet of science? You give the child English letters at five or six, and let him grow up, through long practice in easy lessons, with fairy stories and picture books, and tales of travel and adventure, to the capability of reading and comprehending the masterpieces of literature; yet it is only on the day when the young man begins the scientific study of optics, for example, that you give him a definition of light and show him simple experiments in reflection and refraction. The student should at this age be unable to remember when he did not know these things; and no amount of hard work in after-life can ever wholly make up for the lack of early familiarity with the subjects of

what is best to be left undone. Such a scheme could manifestly be extended to embrace nearly all the practical topics involved in any system of ethics without raising any sectarian issues. It would, moreover, constitute an excellent beginning for a course in civics.—*From a Symposium, "Can morality be taught in the public schools without sectarianism?" in the "Christian Register," January* 31, 1889.

his study, the value of which every instructor acknowledges in other branches of education, whether relating to literature, to morals, or to practical affairs.

Time will not serve for an extended illustration of this subject. A child of ten or twelve years is capable of understanding the principle of the lever just as perfectly as did Archimedes of old Syracuse. Once implant that conception in his mind and it becomes germinal and, without watering or tending, will bear fruit perennially through all his life.

A child of the same age can comprehend the principle of the arch, when illustrated by a few blocks from a carpenter's shop, as fully as does the architect who hangs a stone dome one hundred feet in air; and when he has once comprehended the construction and office of the arch, his eye will never threafter fall unintelligently upon an example of it. A child of the same age is capable of comprehending the law of perspective. Why in the name of common sense should one go on for years, walking through our streets or over our fields, his eye falling at every glance upon some object which is subject to this law, and yet never be instructed regarding it?

Do you ask how much of the elements of physics and mechanics should be given to the child of tender years? I answer: just as much as he will take, be the same more or less. And it is always safe to offer him a little more than he will take. It can't do him any harm. Cramming him with hard and lumpy facts, from so-called geographies or histories, may produce mental indiges-

tion or colic;[1] but an idea, an apprehended principle, never yet hurt a human being, and never will, to the latest syllable of recorded time. For myself, I would not stop short of teaching a child the doctrine of the

[1] I think that the introduction of the system of what I call mechanical education in the schools of Massachusetts and Connecticut, as I have known them while a member of the State Board of Education, would have the effect to crowd out and extrude from our common schools one-half the geography and one-half the arithmetic and one-half the grammar that is now taught. It would have a beneficial result even if nothing were substituted that was itself directly beneficial.

Take the simple study of geography. The amount of gazetteer information that is crowded into our grammar-school course is positively absurd. I remember once asking my little girl, twelve years old, some question which I did not suppose she would answer, but rather to tease her, and she replied: "I can't tell you that, papa, but I can tell you the names of all the principal towns in Siberia." I was at the time a professor of history, and I didn't know the name of a town in Siberia, and I don't want to. It is not of the slightest consequence for any literary or specific purpose that I should. Take another case:—I do not want to revile the common schools, but I think it is fair to state it;—one of my boys, twelve years old, came home one day and said that the supervisor was to come on in a few days and to examine the boys in geography; and, to meet that examination, that boy of twelve got forty-four fair-sized pages, which he wrote out himself in order to get it more thoroughly, of information of a purely gazetteer, encyclopedic character. Thirty-three cities of Asia were on that list, and that boy not only got it up, which might have been reasonable work, but committed it to memory.

Now, such information is of no earthly value whatever to any scholar for any purpose, because no man can afford to put into his memory all that is in a gazetteer. He has neither the nerve nor brain power to put it there. It is highly artificial work, and he has other needs for those powers without straining them so much in one direction. There is no psychologist in the world who would for a moment approve of such studies for boys of twelve, and if they could be extruded from the common schools it would be an advantage to the pupils.—*From Testimony before the Committee of the Senate of the United States upon the Relations between Labor and Capital*, 1885.

persistence of force through all its transmutations. Doubtless he would at first fail to apprehend it fully; yet he would gather something from its familiar, picturesque enunciation; and, as the proposition became familiar to his ear, and as illustrations of the equivalency of motion, heat, light, and sound were multiplied and repeated to him, I should hope that he would grow into an apprehension and appreciation of this grand, all-embracing law.

If it be asked of what advantage would it be to the youthful mind that it should be taught these and the like things, I answer: first, that if to observe phenomena quickly and clearly, if to reflect closely and justly, if to acquire an habitual and, in time, instinctive disposition to trace effects to their causes, if these things be among the prime objects of education, comparison may be challenged between the matter of study that has been described and the work that now takes up two-thirds of the time of the scholar of the age we have been considering. Secondly, that if the direct usefulness of the information acquired be adopted as the test of different systems of education, the elements of geometry, physics, and mechanics have preference, in an enormous degree, over the traditional studies of the primary and grammar schools. But, thirdly, that the main argument for the early acquisition of these elements is to be found in their usefulness as a preparation for the study of geometry, physics, and applied mechanics in later years.

While altering in a degree the traditional curriculum of the public schools by the introduction of the elements of geometry, physics, and mechanics, I would recommend the extension of the drawing-practice of the schools even beyond the point to which it is now carried in our most enlightened cities. And it is a consideration of prime importance in this connection that great as is the interest awakened by drawing-practice, under the better teachers, even as students are now prepared for it in our public schools, those exercises would acquire a vast increase of attractiveness from the studies already described in the elements of geometry, physics, and mechanics. The pupil would in a higher degree appreciate much that he was called to do in his drawing exercises, and would find a heightened pleasure in the practice of this art as it became a means of expressing principles with which he had been made familiar. And as the drawing exercise received a great enhancement of attractiveness through the pupil's comprehension of the principles underlying the figures and designs to be constructed, so, at the other end, would it receive a fresh addition of interest by being correlated with the shop-work in wood, in iron, and in clay, which, according to the friends of industrial education, should form a part of the exercises of the public schools.

We here reach the last stage of our subject. Industrial education involves, first, the teaching of the elements of geometry, physics, and mechanics; secondly, drawing; and, thirdly, shop work of one kind or another.

During the past few years practice in the mechanic arts, especially in wood-working, but also in forge, foundry, and lathe work, has been introduced as an integral part of a system of education, in several sections of the country. No one is known to have been in any way connected with this new kind of teaching who is not an enthusiastic believer in its beneficent effects at once upon the scholar and upon the general system of public instruction; while, of late, converts have been rapidly made from among those who formerly doubted or denied the expediency of this innovation in education. The year now closing has seen the schoolroom space, the apparatus and machinery, and the teaching force devoted to this work more than doubled, perhaps we might say trebled. The next year will undoubtedly witness an even greater increase. The thing is coming, and coming fast, faster probably than the means can well be provided; and doubtless mistakes, not a few, will be made in the haste to introduce this kind of teaching.

In general it may be said that the course of propagation is likely to be from the high school downward to the grammar and then to the elementary schools, and from the city outward through the small towns to the rural districts. The chief difficulty to be encountered will not be the difficulty of finding means, or the opposition of school committees or boards of aldermen, but the lack of competent teachers. In this view the State of Massachusetts has wisely initiated practice in the mechanic arts in two of its normal schools.

At the Massachusetts Institute of Technology, which eight years ago,[1] under the enlightened administration of Dr. Runkle, established a school of the mechanic arts, the applications for instructors in this department are already far in excess of those which can be met. Dr. Runkle has, within a few weeks, issued a pamphlet[2] which embraces in condensed form many well-considered suggestions regarding the organization of this kind of schools, with detailed statements as to the equipment of shops for instruction in the mechanic arts. The reports of the St. Louis Manual Training School, under the supervision of its capable and enthusiastic director, Professor Woodward, contain information of great value regarding the new form of education.

The advantages to be anticipated from the introduction of training in the mechanic arts into the grammar and high schools of the land are many and important.

First, it will increase the freedom of industrial movement, allowing our youth as they leave school to find for themselves places in the industrial order with more of ease and assurance than at present. This, as has been said, is in contradiction of a vague popular opinion that the proposed system is in the direction of class education; but the principle is undeniable; only the degree of its importance can possibly be disputed.

A lad of fifteen leaving the grammar school, or a lad

[1] That is, in 1876.—Ed.

[2] Report on Industrial Education, by John D. Runkle, LL. D., Walker Professor of Mathematics, Massachusetts Institute of Technology. Boston: W. F. Brown & Co.

of eighteen leaving the high school, is not required to become a mechanic because he has had long practice in the use of tools, because he has acquired a familiarity with the materials of construction, because he has become neat, dexterous, and expert in manipulation, because he can make a working-drawing of a piece of machinery or furniture; because he has had his sense of form, of magnitude, and of proportion trained to the nicest discrimination, and because he can work with his eye and his hand as well as with his brain, and with all of these in the closest coöperation. But if he *is* to become a mechanic, he will have a much wider choice between individual trades, by reason of these things; and again, when he has chosen his trade, he can acquire the special knowledge and the special skill requisite thereto in one-half the time which a mere apprentice would take, and he will acquire them, moreover, to much better effect; while, still again, he will be a workman who, after a few years of practice, will be fit, by reason of ability to make working-drawings, of knowledge of mathematics and mechanical principles, and of superior mental training, to be promoted to the post of foreman or superintendent of construction; or he may set up for himself as contractor or master, with a prospect of success far exceeding that of one of equal natural abilities who has enjoyed only the special training of a single trade.

Secondly, so far as the graduates of the reformed grammar and high schools are *not* to become mechanics,

they will certainly be no worse off, by reason of this training; but in many ways they will be the better qualified, even in commercial pursuits or in clerical capacities in connection with manufacturing or railroad enterprises, to make themselves useful to their employers from their manual dexterity, the capability of using tools, and the special knowledge acquired in school. But far more than this will be the advantage derived from the training of the perceptive powers, the formation of the habit of observation, and the development of the executive faculty, the power, that is, of doing things as distinguished from thinking or talking or writing about them. To these the traditional curriculum of the schools fails to minister in the smallest degree; and the longer mnemonics, analytics, and dialectics are exclusively pursued, the farther is the student carried from the temper and qualities of mind which achieve success, except in a few closely restricted and already overcrowded professions. It is the sense of this which leads so many parents to withdraw their children at an early age, reducing the number who go forward from the grammar to the high school to a petty fraction of the whole number.

With the school exercises modified and diversified as has been proposed, I sincerely believe that the average period of attendance would be at once appreciably increased, and that parents would withdraw their children only at the demand of pecuniary necessities which could not be denied, and not, as so largely now, because they

feel that the school is doing nothing practically useful for their children, and, indeed, that the longer they stay, after fifteen, the less will they be fitted for the work of life.

Thirdly, the introduction of shop work into the public system of education cannot fail to have a most beneficial influence in promoting a respect for labor and in overcoming the false and pernicious passion of our young people for crowding themselves into overdone and underpaid departments, where they may escape manual exertion at almost any sacrifice. This tendency of the times has been loudly complained of, but how have those a right to complain who support the old order of things under which all the praise and all the prizes of the school are bestowed upon glibness of speech, retentiveness of memory, ease or force of declamation, and skill in dialectics? If the authority of the State and the influence of the teacher combine to set up such a standard, what wonder that the pupil accepts the same view of what is admirable and desirable, holds other qualities in little esteem, and deems himself too fine for a common trade and a humble calling? Let the State honor labor in the school; let some of the praise and some of the prizes go to neatness of manipulation, skill in the use of tools, taste in design, patience and ingenuity in execution; let the pupil see his master, now and then, with his coat off and a paper cap on his head, teaching the use of the plane and the lathe; give the boy to know the delight of seeing things grow and take shape under his

hands, and it requires no prophet to assure us that our young people will come to look on life very differently and much more wisely.

Fourthly, the consideration which weighs more than any other, in my mind, is that the introduction of shop work into the public schools, closely affiliated with exercises in drawing and design, will give a place, where now there is no place at all or only a most uncomfortable one, to those boys who are strong in perception, apt in manipulation, and correct in the interpretation of phenomena, but who are not good at memorizing or rehearsing the opinions and statements of others, or who, by diffidence, slowness of speech, or awkwardness of mental conformation, are unfitted for mental gymnastics. It is mighty little that the ordinary grammar or high school does at present for scholars of these classes. Not only do they, at the best, get little personal pleasure from their work and receive little of the commendation of the teacher, but, in the great majority of cases, they are written down blockheads at the start, and have their whole school life turned to shame and bitterness. And yet it not unfrequently happens that the boy who is so regarded because he cannot master an artificial style of grammatical analysis, isn't worth a cent for giving a list of the kings of England, doesn't know and doesn't care what are the principal productions of Borneo, has a better pair of eyes, a better pair of hands, and, even by the standards of the merchant, the manufacturer, and the railroad president, a better head, than his teacher.

I desire not to exaggerate; I wish to speak with the utmost seriousness and in strict truthfulness. Of how much advantage is it to a scholar in the average grammar school of Boston or New York or Chicago, in doing his work or in earning the praise of his teacher, that he has a quick perception of form and color; that he sees everything presented to his view at once broadly and particularly, his eye taking in all the features of an object in their due order and proportion, his mind justly interpreting the significance of each and every feature by turns and in the whole; that he has a subtle touch, great patience under vexation, an ingenious and inventive mind? There are as many boys in our schools of whom the above can be said, as there are of boys who are quick to memorize and rehearse the opinions and statements of others, or who are strong and lively in the gymnastics of arithmetic and of grammar. There are not only as many of the former boys as of the latter, but they are quite as deserving of sympathy and respect, besides being rather better qualified to become of use in the industrial and social order. And yet for that class of boys the school offers almost nothing upon which they can employ these priceless powers. They may, by laboring painfully over the prescribed but uncongenial exercises, escape the stigma of being blockheads; but they can never do very well; they will always be at a disadvantage in comparison with boys of the other class; they will know nothing of the joys of commendation; and it is most fortunate if they do not become dis-

couraged, indifferent, and in time careless or even reckless of their standing. Such boys are practically plowed under, in our schools, as not worth harvesting. The teacher may be ever so pitiful and patient; that matters something so far as the child's happiness is concerned, but, so long as he is kept wholly at exercises for which he is not by nature qualified, it makes little difference as to his chances of success as a scholar.

The introduction of practice in the mechanic arts would strike a responsive chord in the hearts of all boys of the class I have so inadequately described; it would at once give them something to do in which they could excel; it would quicken their interest in the school; it would save their self-respect; to many it would open a door into practical life.

For a partial illustration of these effects, let me refer to the introduction of drawing into the public schools, already so widely accomplished. If the acquirement of this art were absolutely of no value, if the training of the eye and hand involved were put out of account, I fully believe that, in spite of the very shabby way in which this subject has generally been taught heretofore, drawing in the schools has repaid its cost tenfold, simply in the opportunity it has given to a host of scholars to do something well, to their own satisfaction, to the commendation of their teachers, and to the admiration of their mates.

Here is a little fellow who has no aptitude for the traditional studies of the schoolroom. He has either

given way after a short struggle to a feeling that he is a dunce anyhow, and that it is of no use to try; or, after a longer and harder struggle, he has succumbed to a still more bitter and lasting discouragement. He has become accustomed to be blamed at school and at home for his low standing; he has ceased to look for words of approbation; he has learned to expect a look of sadness or of anger on his father's face as his monthly card is presented.

But now a new exercise is introduced into the school, and, after the inevitable blottings and smearings of the first trials, it comes one day to the comprehension of the teacher that this boy has executed his work better than any other scholar; has done best of all something which by authority has been pronounced worth doing. For the first time that lad, who has all the time been struggling with a hopeless incapacity for identifying "appositive modifiers" and "cognate adjectives," hears the sweet and pleasant voice of praise, sees the admiring glances of his comrades fall on him, yes, on him! and feels the pulse of ambition throb at his temples.

With what anticipations of pleasure will this lad hereafter await the signal to take up drawing, with what pains will he execute his work, with what pride hand in his faultless sheets! How changed to him henceforth is the schoolroom; how different, even, sounds the school bell in the morning! If the introduction of drawing has done so much for many a boy, how much more fully and completely will the needs of this class of

youths be met by the introduction of shop work in its various branches of carpentry, forge, foundry, and lathe work, in intimate and vital relations with drawing and with the elements of geometry, physics, and mechanics!

I might dwell on other considerations; upon the impulse to be communicated to invention and discovery, upon the disclosure, here and there, of rare mechanical genius, which, under the old system of education, might have been hopelessly lost in a dreary wilderness of words; upon the value of the arts acquired in saving disrepair within the home, enabling the thousand needed strokes of the hammer to be well and promptly given, securing the insertion of the nail in time that saves nine; upon the virtue which a general mechanical education of the people would have in preserving and exalting the priceless sense of social decency which keeps the fence along the village street in order, the gate hung, the glass set, the shutter in place; but perhaps I have already said enough to introduce the discussion of the question of Industrial Education.

A PLEA FOR INDUSTRIAL EDUCATION
IN THE PUBLIC SCHOOLS
1887

Address before the Conference of Associated Charities of the City of Boston, February 10, 1887.

A PLEA FOR INDUSTRIAL EDUCATION IN THE PUBLIC SCHOOLS.

Those of us who attended the conference of January 20th heard some of the strong arguments presented by the learned Secretary[1] of the State Board of Education in opposition to the general views and purposes entertained by those who favor the incorporation of more or less of so-called Industrial Education with the public-school system of the Commonwealth. While objections from such a source could hardly be welcome to those who are deeply interested in the projected reforms, there should yet be no resentment at their being offered. If our purposes and plans are in general sound and wholesome, they will bear challenge and criticism, and will be the better for it. Discussion—direct, sincere, and earnest discussion—is in the interest of the very cause itself; and the sharper the challenge, and the more cogent the presentation of any and all objections, the better for us, if indeed we are right on the main issue.

Especially is it the duty of the Secretary of the State Board of Education to stand up for the integrity and purity of the schools of Massachusetts, if he deems them threatened from any quarter; and in his main contention, Dr. Dickinson is unquestionably right. The pri-

[1] Hon. J. W. Dickinson, LL. D. Resigning in 1894, he was succeeded by the present Secretary, Hon. Frank A. Hill.—Ed.

mary purpose of our public-school system was education; and it cannot in any considerable degree be made to serve any other purpose than education, without a perversion of agency and almost an abuse of trust. The good old principle that education, so far as the public schools are concerned, should be general, not special; should be liberal, not technical; should be directed to the complete and harmonious development of the faculties of the child, and not to the mere acquisition of arts and knacks which can easily be turned to practical uses—this principle I believe to be as true, and as important to the integrity of our school system, as at any time in our history.

And I must beg you to excuse me for going farther and for saying frankly in this presence, remembering that I am addressing a Conference of Charities, that the public schools should be expected to do little directly in the way of relieving the community from the burden of pauperism. The best that the schools can do for the interests which you have so much at heart is to perform their proper educational work with thoroughness, with efficiency, with enthusiasm. While I am far from saying that no burdens should be put upon the public schools, for the general good, yet I believe that the principle which has been laid down should be strongly adhered to, in good faith and good feeling; and that those who propose any exception thereto should be required to prove their case, against a strong presumption in favor of the purely educational character of all school work.

While thus amply conceding that which Dr. Dickinson claims regarding the proper purpose and scope of our schools, issue may fairly be taken with him as to the educational character of the proposed new studies and exercises. In order to clear the ground for such a discussion it may appear not pedantic and not unreasonable to go back thirty or forty years in our history. Perhaps, also, it may not appear impertinent to offer here a piece of personal experience. I entered the schools of Massachusetts at four years of age, and left them at fifteen to go to college. In all the interval I do not remember ever to have been set to any study or exercise which I could not have done just as well if born without hands, except solely for the convenience of holding a book and turning over its leaves, or of writing on paper, slate, or blackboard; which I could not have done just as well if afflicted with total blindness, except solely for the greater difficulty of learning lessons by having them read to me; indeed, but for this, a blind boy would have had an advantage over me, as being less subject to have his attention distracted by surrounding objects. I do not recall any exercise which I could not have performed equally well without the use of hearing, except only for purposes of communication with the teacher; and, indeed, a deaf child would, but for that, have had an advantage over me, as being less subject to interruption or distraction from without.

Now, who will say that there can be a complete education of the child where the senses are thus neglected?

Let us not, even for a good object, exaggerate the part performed by the perceptive powers; but we may rightfully insist that there should be, in every day and in almost every hour of school life, exercises which call the senses into active operation and hold them in strict attention, while from above, the mind, their master, guide, and helper, observes, records, and interprets all that the senses have to tell.[1]

But this was not all that was lacking in the old education. While the memory was fostered into an abnormal and monstrous growth, nothing was offered which even tended to train the judgment. Indeed, the enormous body of facts which the pupils were expected to receive and cherish, solely upon the authority of others, constituted a direct discouragement to the faculty of judgment and to the spirit of self-reliance.

[1] The great educational value of manual training lies in the method of instruction used. It is the laboratory, or workshop, method,—the same method that has proved so effectual of late years in reforming the teaching of chemistry, physics, and the natural sciences in our high schools and colleges.

This workshop or laboratory method of instruction brings the learner face to face with the facts of nature. His mind increases in knowledge by direct personal experience with forms of matter, and manifestations of force. No mere words intervene. Abstract definitions, statements, and rules are put aside. They are not recognized as knowledge, but only as the frames or cases into which knowledge can be put when once it is got. I firmly believe that the introduction of the manual-training element into our school work will promote still further this salutary reform; that it will tend to abolish the mere nominal teaching, of which there is yet too much, and replace it with real teaching,—a teaching that seeks to develop mental power, rather than to load the memory with words, to make the pupil a possessor of the solid merchandise of knowledge rather than of its empty packing-cases.—*Edwin P. Seaver, Superintendent of Schools, Boston.*

Moreover, there was absolutely nothing in the school studies and exercises of those days which tended to direct and develop the executive faculty; the power, that is, of doing things, as distinguished from thinking about them, talking about them, writing about them. No one familiar with the laws of mind will be disposed to deny that there is at least a tendency, in the protracted study of any subject, apart from putting that study to a practical use, toward producing a partial paralysis of the will, shown in a disposition to procrastinate, to multiply distinctions, and to stand shivering on the brink of action. Finally, and worst of all, the school studies and exercises of that age gave no play to that constructive passion which is inherent in every healthy child's mind —a passion which is so strong that it is readily perverted, through lack of opportunity and exercise, into the passion for destruction, just as every good thing is susceptible of perversion into an agency of evil or mischief. When, in 1843, my father for the first time visited Europe, he brought home with him a box of toys, which bore this inscription:

> "Boys in Holland love to make
> What boys in England love to break."

It is only fair to say that the boy who breaks is the same boy, ill taught and ill trained, as the boy who makes; and that the boy who breaks most is the boy who, if his energies were properly directed, would make most.

Such was the New England school of forty and thirty

years ago;[1] but the results, in education, were not so bad as might be conjectured from this rude description. A great majority of our people lived in isolated farm-houses, or in small villages, where access to the land was easy. Out of school every boy had his stint of work and his opportunities for play in the barn, over the fields, through the woods, where his senses were continually quickened, the faculty of judgment called into exercise, the executive power strengthened, the constructive pas-

[1] In the early days of the Republic, when our system of public education was still in its infancy, mental and manual education were much more intimately connected than at the present day. The industries of the country were still in a crude state, agriculture and a few only of the more necessary mechanic trades having any existence. These trades demanded but little artistic taste, and not the highest manual skill; but the educational needs of the time were quite well met in the apprenticeship system, which existed then in its best form. The master became responsible, in an important sense, for the mental and moral well-being of the apprentice, besides teaching him the manual of his trade, with such knowledge of the theory and such experience as he was able to impart. By his attendance for three or four months of each year during his apprenticeship upon the district school the mental culture of the apprentice was not entirely discontinued; and thus, by alternating between the school and the shop, his mental and manual education were never entirely divorced, but each in an important sense aided the other. During this formative period of the student's life one set of habits was not formed to the exclusion of others which in the end might prove more important.

As time passed, a more marked separation between mental and manual education began to take place. The school gradually improved. Better methods of teaching and a larger number of subjects were introduced, and a higher standard set, all demanding more time from the pupil. But quite as marked a change was going on in the industries. Increased demand led to competition, to the invention of special tools to cheapen production, to a greater subdivision of labor, and to the concentration of the individual upon a very narrow range of work. Thus the apprenticeship system for

sion given scope and swing. By these means, accessible to all, much was done to supply the deficiencies and to offset the evil tendencies of the strictly school education. It would be idle to say that the senses, the faculty of judgment, the executive power, the constructive passion, can be as fully and as harmoniously developed and trained in unregulated play, or in ill-regulated and unsupervised work, as they might be in well-considered studies and exercises directed by capable teachers; but,

learning a trade in its old and best form has passed away, never to return. As it exists to-day, it is an advantage to neither party. The apprentice can only learn a narrow specialty, so narrow, as a rule, that its only value to him is the meager pittance which he can earn from day to day, but at the sacrifice of any further educational advantages; while the master finds it for his interest to pay for the skill he needs, rather than put into his carefully adjusted chain of operations a weak and nearly useless link. In this way the school and the shop have become so widely separated that they are no longer mutual helps, as in past times, in developing the highest capacity or the highest manhood. The student who enters the shop at fifteen for a three or four years' apprenticeship seldom returns to the school; and, on the other hand, the student who completes his high-school course at eighteen seldom willingly enters the shop as an apprentice, with the intention of becoming a skilled mechanic and earning a livelihood by manual labor. His twelve or fourteen years of mental school-work, whether highly successful or not, have through habit, if in no other way, unfitted him for all manual work, even if he has not in many ways been taught to despise such labor. Thus it happens that to-day educators, law-makers, philanthropists, and all interested in the highest good of the largest number of the people, or in the best development of our growing and varied industries, are looking for the remedy through education, not of the head alone, but of the head and hand combined in the same system, in order that the education may lead each pupil to some definite end, or directly to the threshold of some special pursuit; that the student's skill of head and hand combined shall have some small commercial value when he has completed his prescribed course of study.—*Professor J. D. Runkle: Report of the Massachusetts State Board of Education*, 1876–77.

clearly, what the boys of forty and thirty years ago enjoyed in this way was vastly better than nothing.

This last, namely, nothing, is about what the greater part of the boys of to-day enjoy in these respects. The majority of our people now reside in cities or large towns. The boy, when out of school, can no longer resort to the carpenter's bench in the barn; for there is no barn, not even a wood-shed—only a coal-cellar. He may at times be found in a vacant, unfilled lot, having a very poor time playing a very poor game of ball; now and then he may make a laborious expedition to some park or skating-pond for amusement; but during the most of the time he has no resort outside the house except the sidewalk.

Even in the country the state of things has greatly changed within the last forty and twenty years. Formerly the population was almost entirely of native New England stock possessing wonderful dexterity, great inventive power, and a mechanical insight which amounted to genius. At the same time, the mechanic arts, and even the factory industries, were carried on in such a way that almost every person employed might be regarded as a skilled workman. How great the change! To-day these regions are peopled by tens of thousands of Irish and French-Canadians, who have inherited little mechanical insight, and almost no inventive power, and have themselves had small training in the arts of industry. The specialization of manufactures has been carried so far that, in some departments, an operative

often need not be a mechanic in any sense of that term, using only a single tool and performing only a single simple operation from one year's end to another. Even the mechanic arts have been differentiated, until individual skill has largely gone out of them. The carpenter of the old days made sash, doors, and blinds; he planed, matched, and grooved his boards; he built his stairways; he did a hundred things requiring dexterity and fine workmanship. To-day sash, doors, and blinds are made in large factories, wholesale; boards come planed and matched by steam; stairways are built at central points, on specifications furnished, and are shipped ready to be put up. The old-fashioned carpenter has almost disappeared.

Such, to a great extent, are the fathers of the boys who now attend the country schools of New England. Few of them are capable of giving their children that instruction in mechanic arts which every father in the olden time gave his boys as a matter of course. Such, and so extensive, have been the changes in the social conditions of our people. Meanwhile, it is fair to say, the schools have not stood still; but have in no small degree expanded their courses and changed their methods, to meet the new wants of the community. In the country districts, indeed, the studies and exercises remain substantially as they were; but in the cities and larger towns there has been much improvement. For the younger children, the blessed kindergarten has come; and, although the imported article will bear con-

siderable modifications, as assuming an impossible childishness,—a childishness of which no American child, at any rate, was ever guilty,—the kindergarten has come to stay.[1] Although thus far, unfortunately, remaining mainly outside the public-school system, its methods have not a little modified the ways of teaching in the lower grades of the public schools; while in the upper rooms, the objective study of natural science, with plants, minerals, and examples of animal life in the hands of the teacher and of the pupils, is introducing some of those elements which were most painfully lacking in the olden time. Moreover, the general adoption of drawing[2] as a school exercise is doing much to quicken

[1] The kindergarten not only gives the young children a good start intellectually, but it also has a very marked and beneficial effect on them morally. The subsequent instruction and discipline in the primary schools would be much easier, and the progress in knowledge much more satisfactory, if all pupils first took the kindergarten instruction.

It is not necessary to go into a theoretical argument to prove the benefits of kindergarten training. We have the practical demonstration in Mrs. Shaw's kindergartens in this city. It is chiefly from my study of these in actual operation that I have come to believe that we need many more of them—indeed, that the kindergarten ought to be recognized and established as a part of the system of public instruction in this city. There are other large cities where this has been done, to the great benefit of the youngest children. I am not without hope that this great improvement may ere long be brought to pass in this city.—*Edwin P. Seaver, Superintendent of Schools, Boston.*

[2] Drawing, in one form or another, has won its way into nearly all schools in the older countries, and is making rapid progress in our own. While it is the universal language of handicraft, bringing the industrial ends of the earth together, just as the higher and finer arts express the feelings and sentiments of our common humanity, it has at the same time justified itself in all countries as a most valuable

the geometric sense of the pupils, to cultivate their perception of form, and to stimulate the interest of large classes of children who find little to enjoy in the traditional studies of grammar, arithmetic, and geography.

It is at this point that we part company with Dr. Dickinson. He would trust to the continued use of drawing and to the increased use of science-teaching to train the senses, to cultivate the habit of observation, to strengthen the judgment, and to make the hand and eye more ready and faithful servants of the mind. The use of tools he deprecates as injurious to the proper purposes and as disparaging to the dignity of the public schools; while he admits sewing and cooking only as burdens which the schools may be asked to carry for the general good. Most of us, on the contrary, believe that the use of tools in appropriate form and degree, and the teaching of cooking and sewing are as truly educational as any, even the most approved, of the familiar features of the public school; that they supply desirable elements

auxiliary to purely scholastic studies, for developing the intellect, and for widening and deepening the capacity and power of the individual. Nor would it be possible to estimate the value to the industries of the world, of this general cultivation of the intellect and taste through drawing; and yet drawing is essentially a manual art. Whatever of mental discipline or cultivation of taste it offers can only come through the training of the hand as the medium. Little value would be derived by teaching drawing as a science without corresponding practice. It has its body of principles; but they can be better brought to the student's attention, and more clearly set forth, in connection with a well-arranged and progressive course in manipulation.

The same good educational results will surely follow from the systematic teaching of other manual arts.—*Professor J. D. Runkle.*

which can be obtained at all, or which can be obtained as well, from no other source; and that they are not only compatible with the integrity and dignity of the school system, but that they promise greatly to increase the general interest in the schools, if not to become the very salvation of the school system itself; while the incidental advantages resulting therefrom, in raising the industrial quality of our people, in creating respect for labor, in quickening the sense of social decency, in securing a greater economy of the means and the resources of the very poor, and in promoting good citizenship generally, are, as we esteem them, beyond all price.

First: While it is freely and gladly admitted that the objective study of natural science, by modern methods, affords an admirable training of the powers of perception, of the habit of observation, of the faculty of judgment, it cannot be claimed that it does anything towards directing and strengthening the executive faculty, which is so important a factor of success in life; or that it gives any scope or play whatever to that creative or constructive passion which is the highest and most useful instinct in the child's mind, but which is readily perverted into a force for evil.

Second: While the effect of science-teaching in grammar schools, is, theoretically, what has been above admitted, I believe it to be true that it is much more difficult to obtain good, fresh, original, spontaneous work in this direction than can be had in school exercises of the character we are proposing; and that, even when

the best of teaching-talent can be secured, a smaller proportion of pupils will have their interest fully aroused and their mental activities fully enlisted by the study of natural science than by exercises in the mechanic arts, where the perceptive powers and the faculty of judgment are equally called into use, but where, also, the creative or constructive passion is brought into play, to furnish both object and impulse to the youthful student.

Third: While the objective study of natural science tends strongly and tends directly towards moral earnestness, simplicity of character, and intellectual truthfulness as contrasted with the cultivation of mnemonics, dialectics, and rhetoric, it cannot, I think, be claimed that it has any immediate and direct influence in removing that snobbishness of feeling and that dislike and contempt for manual labor which are so unhappily prevalent among our half-educated classes; which are so injurious industrially, so dangerous socially and politically, and which bear an enormous annual crop of ruined lives in the case of tens of thousands of the graduates of our public schools who have been made too fine for manual labor, without having become qualified to take any higher or more useful places in the industrial order, and who thus come to swell, each year, the throng of useless and unhappy applicants for the comparatively few positions in shops, stores, and counting-houses, where a generally poor living may be obtained without soiling the fingers.

On the other hand, no one, I think, can look upon a

class of bright young boys working at the carpenter's bench or around the blacksmith's forge, their paper caps upon their heads, leather aprons and jean overalls protecting their better clothes, their faces flushed with the excitement and delight of construction and creation, without having his heart glow within him at the spectacle, and without the serious conviction that this is as it should be; that it is good for these boys and good for the State that they should learn to do such things, in the name of education and under the authority of the Commonwealth.[1]

[1] First, It stimulates a love for intellectual honesty. It deals with the substance, as well as with the shadow; it gives opportunity for primitive judgments; it shows in the concrete, in the most unmistakable form, the vast difference between right and wrong; it substitutes personal experience, and the use of simple, forcible language, for the experience of others, expressed in high-sounding phrase. It associates the deed with the thought, the real with the ideal, and lays the foundation for honesty in thought and in act.

Second, The good moral effect of occupation is most marked. No boys were ever so busy as ours, in school and out. Every strong, healthy appetite finds its appropriate food. The variety of the daily programme, far from confusing, produces a balance of healthy interests; and not only the boy's time, but his thoughts, are devoted to the work of the school. The correlation of drawing and shop-work with science and mathematical studies is exceedingly helpful on both sides, and parents testify to the absorption of our pupils in their work. Mothers and sisters are never tired of telling of the great convenience of having in the house one who has common sense enough to use the universal tools and to keep things in order. The hands are rarely idle enough to allow the devil to get in his mischievous work.

Third, A third moral benefit is self-respect, and a respect for honest, intelligent labor. A boy who sees nothing in manual labor but mere brute force despises both the labor and the laborer. To him all hand-work is drudgery, and all men who use their hands are to him equally uncultivated and unattractive. With the acquisition

Fourth: When we come to the advantages to be derived by the community at large from the improvement in the industrial quality of its citizens, through the mechanical education of the whole body of our youth and their acquisition and mastery of the elements which underlie all mechanic arts, we reach ground made so familiar by recent discussion that it requires mention only in passing. To the industries of New England in especial this is a matter of transcendent importance. With a harsh climate and a sterile soil, producing few of the materials of its own manufactures, importing its cotton, wool, silk, and flax, without ores of the useful or the precious metals, without even coal for power, New England must rely for its continued supremacy in manufactures upon the skill, energy, and foresight of its employing class, and upon dexterity, neatness of manipulation, care of materials, and mechanical aptitude, on the part of its laborers. We cannot afford to tolerate a generation growing up, as Governor Ames has said in his inaugural message, in ignorance of the use of tools.

Fifth: Among the incidental advantages to be expected from the introduction of the proposed studies and exercises into our public schools, is one which has always seemed to me of great importance, but which is

of skill in himself, comes a pride in its possession, and the ability and willingness to recognize it in his fellows. When once he appreciates skill in handicraft or in any manual art, he regards the possessor of it with sympathy and respect.—*Professor C. M. Woodward, Director of the Manual Training School of St. Louis.*

seldom alluded to in discussion of this subject: namely, the maintenance of that sense of social decency which was once of so strong a savor in the life of New England. No one can pass through any of our villages to-day without being painfully struck by the contrast there afforded with the villages of a generation ago, when, almost without exception, every house was in order and in repair, the fence entire, the gate hung, the shutters in place, the sash fully glazed. Around the house the ground was graded and grassed, and almost everywhere some little garden-patch testified to the universal desire to have things neat, agreeable, and decent. The man then who kept his house and grounds squalid was little less than a public enemy. I need not spend words in showing how great is the contrast in many of our New England villages to-day. The men who, on every hand, allow their premises to remain shabby and squalid, a reproach and blemish to the street, receive higher wages than our fathers ever dreamed of. The reason why they are content to live amid such miserable surroundings is because they have come from lands where nothing better was known, and, secondly, because they have not the dexterity and knowledge of the use of tools which would enable them to do those simple jobs of construction and repair which were to our fathers a matter of course. If we are to reform this state of things, which is alike disgraceful and dangerous, and are to bring about a gradual return to that better and happier condition when a strong sense of social decency, inspiring and controlling all the

members of the community, constituted the best possible guaranty of peace and order, of industry and frugality, we must teach the children of these men the use of tools; and we can do it in no other way than through the public schools.

Sixth: On the subject of sewing and cooking there are many who can speak with much more intelligence and authority than myself; but I yield to no one in appreciation of the importance of these exercises as an integral part of the authoritative curriculum of our schools. So vast appear to me the advantages, social and physiological, to be derived from this source, that, were these exercises in no sense and in no degree educational, I would still lay this duty upon the schools, as a burden to be carried for the general good, and I would employ the authority of the Commonwealth to train every girl within our borders in these all-essential domestic arts. If, as Horace Mann said, it is a crime for a boy here to grow up in ignorance of reading and writing, what sort of an offense is it, pray, for a girl here to grow up in ignorance of cooking and sewing? Think from what kind of homes tens of thousands of our children in the public schools every morning come—rooms disordered and ill-kept, amid foul surroundings, presided over by a mother who cannot decently patch or darn a garment that is beginning to give way, and who knows only enough of cooking to take the perhaps abundant materials supplied her and render them, by dirty and wasteful processes, into disagreeable and indigestible messes,

productive of dyspepsia and scrofula and provocative of a craving for strong drink. As a mere matter of public safety, can we afford to breed such a population in this Republic?

But, in fact, cooking and sewing in the public schools can be made, and, so far as they have been carried, have been made as truly and as strictly educational as the three R's of the primitive schoolhouse. Can anyone look into the rooms of the Winthrop School, when sewing is going on under its wise and benign master,[1] without seeing that the powers and faculties of the children are most actively and harmoniously developing; that character is rapidly and happily forming, as hand, eye, and brain work together, all inspired by the acute delight which the child always feels when creating something useful or beautiful; that, in a word, education in the largest and best sense is here taking place? Can anyone look into the Tennyson-street cooking school, without seeing, in the care and economy with which fuel and materials are used; in the order and neatness which pervade the room—not less the cupboards and lockers than its open parts; in the reasoning which precedes every operation, and the subsequent explanation of effects by well-approved causes, an example of the very best kind of education?

Seventh: I have now reached the regular orthodox number in exposition, and have reserved to the last what

[1] Robert Swan, Esq., to whom Boston owes a debt it can never pay, for the part he has taken in introducing sewing into the public schools.

is, to my mind, the most important consideration. However strictly we may hold to the doctrine that the sole sufficient justification of school exercises is found in their educational character, we cannot deny that the maintenance of the schools themselves, and their ample endowment and support, are considerations which may properly, and which properly should, be admitted to qualify, so far as occasion exists, the organization of schools and the curriculum of their studies.

I heartily believe that the introduction of the mechanic arts, and of sewing and cooking, into the public schools will do much, very much, not only to increase the interest of the pupils in their work,[1] as has been already indicated, but to win for the schools a far larger degree of interest on the part of parents and a far heartier support of the system on the part of the general community.

Indications are not wanting that powerful elements of hostility are beginning to array themselves against free public schools,[2] with compulsory attendance, main-

[1] It was thought also, that taking a part of a class away from its regular school work would result in more or less detriment to its progress in the prescribed studies. Here and there a complaint was made by the teacher of some second-class boy, that he was not doing his work well in his own room; but the pupil, in every case, was so anxious to remain in the "carpenter's class," that a word or two of warning was sufficient to bring his performance up to standard again. . . I consider that the results go far to prove that manual training is so great a relief to the iteration of school work that it is a positive benefit, rather than a detriment, to the course in the other studies.—*James A. Page, Master of the Dwight School, Boston.*

[2] The importance and necessity for the extension of our system of public-school education, so as to include some form of industrial

tained under the authority and at the expense of the State; while, perhaps more dangerous still, appear signs of disaffection and indifference among vast numbers who have no reason to be actively hostile. I believe that nothing will go so directly to the root of this evil as the reforms which this meeting has been called to consider; and that, not less for the schools themselves than for the scholars, will there be found great virtue in the admission of the elements of industrial education into every schoolhouse of the State, however humble and however remote.

training, has been constantly increasing during my twelve years' service on the Boston School Board.

To my mind, equity, morality, good citizenship, and the industrial welfare of the community, are all involved in this question. When we think of the difficulties placed in the way of learning trades, by the virtual abolition of the apprenticeship system, and by the fact that our educational methods train the boy away from the mechanic arts in a country with unequaled opportunities for their exercise, we must admit that, up to the present time, we have considered but one side of the general subject. Now, however, the growing pressure of public opinion demands a change, and I confidently look forward to the completion of our system by the introduction of technical schools. In these, the grammar-school boy, led by his inclination or his necessities, can be educated as thoroughly in the preparation for mechanical work and skilled labor, as his brother in the high and Latin schools is for business and the professions.—*Dr. J. G. Blake, Boston.*

MANUAL EDUCATION IN URBAN COMMUNITIES

1887

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MANUAL EDUCATION IN URBAN COMMUNITIES.

As we pass from rural districts and small villages to large towns and cities, the need of what is called manual education, or what I should prefer to call mechanical education, increases palpably and rapidly; while the difficulty and relative cost of instituting and maintaining the required services of instruction diminish in an almost equal ratio.

In the country, the boy finds a hundred opportunities, alike at work and at play, for acquiring much of that which can be given to the city boy only by way of formal instruction. Whether in his daily stint of labor, upon the farm, about the house, the barn, the sheds, or in his sports or rambles, upon the village green, over the field, through the woods—the country boy has incessant occasion to use his hands and his eyes; to observe, to plan, to do.

It would not become us, as teachers, to admit that what is thus done is as well done as it would be if the foundation were properly laid in systematic instruction; that the boy can, for himself, or under the guidance of older persons themselves untrained to teach, themselves largely unintelligent as to means and processes, often working by "rule of thumb" and pursuing purely traditional methods—that the boy can, under such condi-

tions, either accumulate knowledge or acquire skill and training as well and rapidly as he would under good tuition. We all know that one may play at games or work at tasks for years, without learning to do either as well as might be accomplished in a single year under a true master, a master both of the special arts involved and of the greater art of teaching. No one can have widely observed mankind without being painfully impressed by the obtuseness and perverseness which cause advantages near at hand to be lost, the plainest reasons for the phenomena of daily life to be overlooked, the most natural and direct ways of doing things to be neglected for stupid and clumsy and wasteful methods, all from the lack of elementary instruction in first principles, and of the formation of habits of observation and reflection, under systematic tuition.

Yet in spite of the deficiencies which remain, what the country boy enjoys in the way of training hand and eye to be true servants of the mind; what he enjoys in the way of opportunities and incentives for making the mind itself the real master of life, through a well-rounded and harmonious development of all the powers, through the creation of the spirit of self-reliance, through the exercise given to the constructive and executive faculty, is almost infinitely greater than that which falls to the lot of the unhappy city boy of to-day. Out of school, what has the latter to do with himself, his time, or the energy given him, as we are wont to say, for some good purpose, though it would puzzle the most de-

vout and the most ingenious to tell for what purpose energy should have been given to a boy condemned to live in a modern city?

Work he cannot, for, except in the rarest instances, there is nothing useful for him to do. No matter how poor or even how poverty-stricken his family, it would be almost impossible for him to contribute to the common means. In the olden time, such a boy could have helped his father or mother to spin or to weave. To-day, one buying flax or cotton or wool to work upon, in the intervals of schooling, could not get back the cost of his material in the price of his product, sold in competition with the output of the giant factory and its power looms. In the olden time, such a boy could have carved in wood or worked on metal, or have helped his father make furniture, boots, gloves, or hats in the family home. To-day, nearly every art of domestic manufacture has utterly disappeared, leaving not a trace behind. It is almost impossible now for even the women of the family to find any work by which they can add the most trifling amount to the common means.

So highly organized is modern industry, so exacting are its requirements, that no one wants the fragments of a boy's time, for any productive purpose. A lad who cannot give his whole day is not, in one case in a hundred, worth having around.

Let us pause a moment to consider what this means. A generation ago, not in the country only, but in every city and town, there was an abundance of useful work

to occupy the time and energy of almost every schoolboy out of school. These tasks constituted a most useful part of his training. They wrought into the very fabric of his being the idea and sentiment of a common family interest; they gave scope and play to the creative and constructive faculty; they trained eye and hand to accuracy and precision; they taught the child to respect toil and to value the fruits of toil; they sweetened the bread of poverty; they made the sleep of childhood sounder. To-day, under the new conditions of production, it would, in almost every city home, cost more to keep a boy usefully employed than to feed him in idleness.

Do you say: "Well then, let him play, if he cannot work"? I answer that, in our modern cities, even outdoor play, of any satisfactory sort, is scarcely practicable. Search the city of Boston on a pleasant Saturday afternoon; and out of thousands of boys, who should be doing something with energy and enthusiasm, their muscles all strung, their blood tingling in their veins, you will not find one in fifty doing anything which would be even a poor caricature of country sport. On the famous Common, you will see two or three balls being pitched or knocked about, while a large crowd of idlers look on. In a few vacant and unfilled lots, you will find a very poor game of base-ball or foot-ball going on. Some scores of lads have, perhaps, had the moral courage and mental initiative to go upon tramps into the country. All the rest are either walking the streets, or loafing in

the parks, or hanging about the house. Of this last—by far the greatest—class, some are lounging, moody, bored, and discontented; some are revenging their unhappy lot by pestering their mothers and the smaller children; some are further muddling their brains by reading or study, of which they have already had too much.

Such and no greater are the opportunities and incentives afforded the city boy of to-day for acquiring knowledge of things, for training the perceptive powers, for forming habits of observation, for discriminating between phenomena and interpreting their just significance, for exercising the constructive and creative faculty, which is the most godlike thing in man. This brief survey will, I trust, be held to justify my assertion that, as we pass from rural districts and small villages to large towns and cities, the need of what is called manual education, in connection with the school system, palpably and rapidly increases.

On the other hand, the burden of instituting and maintaining instruction in the mechanic arts diminishes as we pass from rural to urban communities quite as rapidly as the need of such instruction increases. This is due, not alone to the comparative poverty of agricultural populations, although the inability of many districts of this class properly to support schools, even of the traditional type, constitutes one of the gravest educational problems of the time. This result is in a much higher degree due to the concentration of population in

commercial and manufacturing communities, allowing the same amount of apparatus and supplies, and the same amount of skilled service to do a vastly greater work of instruction than would be possible in rural districts. It is not necessary to contrast the small schoolhouses, widely scattered, which serve the purposes of an agricultural population, with the twelve-room buildings, thickly set, in which the children of our cities and large towns receive elementary instruction, in order to show the greatness of the advantage which would be enjoyed by communities of the class under consideration in the matter of manual or mechanical education. The difference, in this respect, between city and country must be obvious on the merest mention. Where children, by thousands, are concentrated in narrow districts, the question of providing the means of instruction in the mechanic arts is little more than the question whether such instruction is itself desirable.[1] The technical teacher who, in the country, could reach only a few small classes, for a single lesson in a week, would, in the

[1] I think there is no city of ten thousand inhabitants in this State [Massachusetts] which could not within a year set on foot a high school of the mechanical arts, which should be either immediately connected with its high school or located at some short distance from it, according to the expense or other considerations involved. . . In those schools I think the high-school children from fourteen to eighteen should be trained in carpentry and joinery, and in work at the forge and at the lathe; trained in the mechanic arts; taught to make things; taught to impose their ideas upon matter, and to compel it to take the form which they have chosen for it.—*From Testimony before the Committee of the Senate of the United States upon the Relations between Labor and Capital*, 1885.

city, find his power of instruction limited only by his own strength and vital force. The apparatus and tools which in the country could serve but a few score of pupils would, in the city, serve as many hundreds. Even the supplies, purchased at wholesale and requiring little transportation, would cost the city school board much less than the rural school committee.

So great is the total effect of these differences of condition, that it may be safely said that a city of ten thousand inhabitants could provide instruction in a variety of mechanic arts, under the best teachers, with the choicest apparatus, tools, and machinery, and could carry its pupils from stage to stage through an extended mechanical education, at less expense than would be required to give the same number of pupils, in rural districts, a rude course in a single art, under the cheapest arrangements that could be made as to teachers, tools, and supplies.

The concurrence of the two conditions indicated, namely: the greater need of manual or mechanical education in cities and large towns, and the diminished cost of instituting and maintaining such a system of instruction in communities of this class, and, I might add, the greater financial resources there available to do whatever may be fairly determined to be for the good of the rising generation—this concurrence of favorable conditions seems to me to establish the expediency of beginning in our cities and large towns whatever it may be decided to undertake in this matter. Here it is the ma-

chinery should be earliest set up and put to working. Here it is we may most fully and conclusively determine the capabilities of the system, ascertain the unfortunate liabilities, if any, to which it is subject, and create that body of experience which is essential to its full and perfect development. Here, too, it is we should train the teachers who will be needed for the extension of this kind of instruction, outwards, stage by stage, from more to less compact communities.

Whether, within urban communities, the development of the system of manual education should be by a gradual extension downwards from the high school, or upwards from the grammar school, is a question deserving the careful consideration of all interested in this subject, a question on which light may perhaps be thrown by experience. The most popular procedure at the present time, in promotion of manual education, appears to be the institution of high schools of the mechanic arts, as in St. Louis, Chicago, and other Western cities, the question of such instruction in the grammar schools being left to the future.

In Boston, in addition to a small private high school of mechanic arts,[1] we have introduced instruction in carpentry, to a limited extent, into the grammar schools.

When Lady Hamilton asked the sailor who had brought her a message from Lord Nelson, whether he would have a glass of ale, or a little rum, or should she

[1] In 1894 was established the existing Mechanic Arts High School as a part of the public school system.—Ed.

brew him a punch, Jack, with a proper pull at his forelock, replied, "Well, your ladyship, I'll take the ale now; and be sipping my grog while your ladyship mixes the punch." I am disposed to think that we should deal with this question of the introduction of manual education in our schools, in somewhat of Jack's rather grasping spirit; that we should take all we can get, and this as soon as possible. Not that I am anxious to hasten the complete result, namely, the universal introduction of manual instruction into our public schools for at least all scholars above the age of twelve; not that I am sanguine of immediate success in whatever may be to this end undertaken; not that I overlook the probability that some part of what may be attempted will result in failure; but it seems to me that, where so great a task is before us, the sooner we get to work, somewhere, somehow,—almost anywhere, anyhow,—the better. In such a case there is more waste in doing nothing than in many mistakes made in doing something. This is not a situation to which applies Davy Crockett's maxim: first be sure you are right and then go ahead. The very thing we have to do is to make experiments, to create experience.

We know we are right in our general principles. The best expert opinion coincides with the increasing conviction of the community, that the traditional curriculum of the schools needs to be essentially modified, through the introduction of studies and exercises which shall train eye and hand; which shall cultivate the per-

ceptive faculties, so long and grievously neglected; which shall create a respect for manual skill and dexterity and for taste in design; which shall afford scope and play for the creative and constructive instinct. Just what these studies and exercises shall be, in character and order of succession, is to be determined by experiment rather than by forecast. The question is one which requires to be worked out rather than to be thought out. The most that is likely to be done in the immediate present will not be more than to accumulate experience, determining the direction which our efforts in this interest shall ultimately take.

One thing seems reasonably well established, namely, that carpentry and wood-turning are the arts with which we may most advantageously begin with grammar-school pupils. Work in these lines is sure to interest both children and parents. It is easier to get competent teachers than in any other of the arts. The expense of machinery, tools and supplies comes fairly within the means of any urban community. The practical value of the acquirement of these arts is palpable to the least instructed mind. The last consideration is, however, one on which the advocates of manual training must not greatly dwell, since the strength of their position lies in the claim that such studies are, truly, purely, and highly, educational,[1] being actually required, in addition to the

[1] Industry, as such, has, in my judgment, no place in the public schools, though industriousness is always in order there. The prime object of our school system is education, and it cannot be to any considerable extent diverted from that end without injury to the schools

familiar studies of the public school, to secure the complete and harmonious development of the powers and faculties of the mind.

That the introduction of these or any other mechanic arts into the grammar schools would give new direction and a fresh impulse to the study and practice of drawing, is certain. I agree with Dr. Runkle, that drawing in the public schools, not directed upon work in the mechanic arts, is not one-half of what it would be as an educational force had it a definite object. I look with confidence to see this most interesting and promising study receive a new inspiration wherever the use of tools is introduced into the schools.

One thing more I will say regarding the inauguration

themselves and to the community at large. Indeed, it would scarcely be possible to do a greater wrong to the major part of our public-school children than by taking any appreciable share of the little time they have for the development and training of their intellectual powers, for the purpose of applying it to the mere means of bread-winning or money-making.

But while I thus hold strongly to the strictly educational character of school work, I believe that the courses of study in the schools of New England have been, and, though in a diminishing degree, still are, incomplete and inadequate to the demands of a full and symmetrical education. I believe that these deficiencies have induced a one-sided development of mind and character; have led to the setting up of false standards of what is admirable and desirable in life; have caused to be magnified glibness of speech, force of declamation, readiness in recitation, and retentiveness of memory, at the expense of far more useful faculties, qualities, or habits, namely, soundness of judgment, clearness of perception, the habit of observation, the creative instinct, the executive faculty.

Briefly speaking, my project of reform, in schools for boys, would be as follows: carry the best-approved methods of the kindergarten upward through the primary grades, as far as the means and resources of each school, for itself, will allow; introduce more and

of this system, which is, that the friends of the new education should refuse to accept less than two exercises of an hour and a half or two hours each, per week, in the mechanic arts. Wherever committee-men and teachers are not prepared to grant so much as this, cannot see their way to clear at least this amount of space for the mechanic arts, it would be well, in my judgment, though I speak with some hesitation, to await a more fortunate time and a better disposition on the part of those who control the schools.

Whatever other arts may, in the development of this system, come to be associated with carpentry and wood-

more the study of form, color, texture, structure, and organization, by means of natural objects in the hands of pupils and teachers, stimulating and encouraging the pupils, more and more as their faculties are developed, to make observations for themselves at their play or at their work, and to bring the results back to the schoolroom, for comparison, for criticism, for discussion; at the age of twelve, or thereabouts, introduce semi-weekly exercises with tools, preferably wood-working tools, and in clay-modeling, for the cultivation of the sense of form, for the training of the eye and hand, and for gaining the power to give material shape to conceptions of the mind; at fourteen years of age, or thereabouts, introduce exercises in metal-working, and require every boy who passes through one of the high schools of the State to become a good mechanic, not at all for the sake of his practicing a mechanical avocation, but to make him a better equipped, more capable, and more useful *man*.

All this could not be done at once. The system would have to be introduced gradually and tentatively. Probably the more natural order would be that the system should extend from the higher schools downward, and from the city schools outward. Much would be learned in the course of the gradual development of such a system; and the best-conceived programme would doubtless require considerable modifications, as the result of experience.—*From a Symposium: "What Industry, if any, can profitably be introduced into Country Schools?" in "Science," April* 15, 1887.

turning in the grammar schools, it appears to me that, at the very beginning, we may demand a complete course of both wood- and metal-working for that smaller number of advanced pupils who go forward into the high school. If it is for the interest of the State that these young persons shall, at the public expense, be further educated and cultivated on one side of their minds, it is not equally, but doubly, desirable that the education and cultivation of their other powers and faculties should be kept up in the high school. It is little less than a shame that we should graduate from these schools pupils who are highly accomplished in language, composition, and declamation, but are less keen in perception, less careful in observation, weaker in practical judgment, with less of visual accuracy, less of manual dexterity, less of the executive faculty—the power, that is, of doing things instead of merely thinking about them, talking about them, and writing about them—than the children of the ordinary ungraded district school.

Whatever views one may hold of the mutual relations of the child and the State in the grammar school, it can be gainsaid by no one that, if the community is to be called upon to carry the more favored children forward, through long and expensive courses of advanced education and training, those men who, on behalf of the community, direct the schools of this class have the absolute right to impose terms and conditions, to exact and to withhold whatever the public interest may require.

Cherishing the views I do as to what constitutes a complete education, I would allow no pupil to graduate from a high school who was not as proficient and exact in mechanical as in grammatical exercises; I would not make myself responsible for adding to the number of youth who have been trained in description, without having been taught to observe the things they should describe; who have spent years in the art of rhetorical elaboration and ornamentation, without acquiring any adequate body and substance upon which to exercise those arts; who are clever in dialectics and declamation, but purblind in perception and feeble in execution; great at second-hand knowledge, but confused and diffident when thrown upon their own resources; skillful with the pen, but using any other tool awkwardly and ignorantly.

The mischief we can possibly do, through a one-sided education, to those who stop short with the grammar school is, fortunately, limited. These children, escaping from tuition before they have got their growth and going at once to work, have an opportunity to cure in part the faults and to supply in part the deficiencies of their education. That work, of course, does them far less good, and they do it far less well, than if the foundation had been laid in early youth, under proper guidance and instruction. Yet, at least, they are saved from growing up and growing out all on one side, like the unhappy youth who are destined to go on, for three or seven years more, rehearsing the opinions of others; memorizing facts ascertained by others; practicing a

simulated passion in declamation, an artificial taste in composition; making much of grammatical niceties, painfully polishing periods without much regard to the thoughts these should inclose; going over and over a weary round of second-hand information and second-hand ideas, and acquiring a few purely conventional accomplishments.

We hear much of the contempt of so-called self-made men toward scholars; of their distrust, in practical matters, of school-made and book-read men. Doubtless some part of this feeling is of vulgar origin, due to jealousy, envy, or ignorance; but a far better part I believe to be perfectly just, arising from a correct apprehension of the natural effects of long-continued study and exercise within the traditional lines of high school and college instruction, producing a disposition to hesitate, to procrastinate, to multiply distinctions, to refine in preparation, to stand shivering on the verge of action. Doubtless, many school- and college-bred men, when thrown into action, are found to have enough of robust manhood to overcome the ill effects of their early training, especially if in school or college they were not very good scholars. But would it not be better from the first to associate with the dialectical, grammatical, and rhetorical exercises of our schools and with the perhaps necessary acquisition of much mere gazetteer, cyclopedia, and dictionary information, studies and exercises which shall not only prevent the formation of distinctly bad habits of mind and will, but shall positively develop

those powers and faculties which the very first access to the duties of professional and business life shows to be the most useful of our endowments?

I believe that the introduction of the new studies and exercises which we are advocating will not prove a mere addition to the work of the school or college. I believe it will also profoundly modify the instruction given within traditional lines. Boys and young men who have learned to observe for themselves, to acquire knowledge at first hand, to give effect to their purposes and form to their ideas; who have been accustomed to impose their will upon matter and to make it take shape to suit their intellectual conceptions; who know how to project, to plan, to execute; will have little patience with much that makes up the traditional curriculum. They will demand to be brought face to face with facts. They will insist upon going to the bottom of any matter they have to deal with. That genuine intellectual honesty, which is the first fruit of the objective study of concrete things, will make them scorn to defend, in dialectical and rhetorical practice, theses which they do not thoroughly believe. They will grudge every hour spent in memorizing matters for which they can at any time resort to the gazetteer or cyclopedia. It will be hard to impose on such students with sounding names, deceive them with sophistries, or bear them down by authority. They will care much for principles; little for the manner in which these may be dressed up for effect, or tricked out for public admiration.

The access of bodies of students of this character cannot but profoundly modify the subjects and the methods of instruction of any school they enter; and every change wrought by the infusion of such a spirit will be sure to prove of benefit to scholar and to school alike.

I have, thus far, spoken only of the educational needs of our boys. How far the traditional courses of study shall be modified in the case of girls is a nicer question, respecting which it will not be unreasonable to await light from whatever experiments may be tried with children of the other sex. It would seem to be the dictate of wisdom to solve the easier part of the problem first.

That young women may become heartily interested in studies and exercises in the mechanic arts and may make themselves proficient at least in carpentry, is established by our experience at the normal schools of Bridgewater and Salem, Massachusetts. That such instruction, for those who are to become teachers, yields a professional accomplishment of prime importance, enabling the schoolmistress, especially in the rural districts, to make and repair much of the apparatus for teaching natural and physical science, is evident. This work cannot be too strongly pressed in all normal and training schools.

As regards grammar schools, I confess that my ambition would be satisfied, for the present, by the introduction of sewing and cooking, until the full capabilities of these two kinds of school exercises should be fully developed and fairly tested. The triumphant success which

has attended the extension of sewing through the lower grades of the grammar schools of Boston, and the admirable results which have been attained, so far as the cutting, fitting, and making of plain garments have been introduced into the upper grades of three districts,[1] have put this school exercise beyond the stage of experiment. No intelligent and candid person, who thoroughly knows the work done in this department, any longer questions either the practical utility of the results achieved or the appropriateness of sewing in the school curriculum, as a strictly educational agency.

Of equal promise of good to our citizenship and, as I believe, not less suited to the prime purposes of instruction, is the newer school exercise of cooking. So transcendent are the social, sanitary, and economic advantages of instruction in this art, in enabling the very poor to husband their resources, in preserving the health of the community, in removing baleful and destructive appetites, in promoting the comfort and decency of the family home, that any educator would be abundantly justified, were that necessary, in making this an exception to the rule that all school exercises should be distinctly educational. Especially in view of the great and painful change in our citizenship which is making such rapid progress before our eyes, does it become a patriotic duty to seize upon the only opportunity which the State enjoys of reaching the members of the rising

[1] Sewing is now a part of the course.—Ed.

generation, and to employ some portion of the time of the children in the public schools for instruction in domestic economy and in the art of preparing food. The practical value of such an accomplishment, in the degree in which it may be acquired in a single brief course, is incontestably greater, to girls coming from poor and squalid homes, as so many tens of thousands do, than all else they could possibly learn in school, beyond reading, writing, and plain ciphering. The importance to the State of such girls acquiring this art, is, from a sanitary point of view, from an economic point of view, and from a political point of view, greater even than the importance of the elementary knowledge just referred to. We are threatened to-day, in the United States, with a lowering of the standard of living and with an impairment of the sense of social decency which would together constitute a greater industrial and political evil than we have known. All the letters that ever were taught in our public schools will not do so much to oppose and counteract these unfortunate liabilities as the two arts of sewing and cooking, properly taught under the authority of the State.

But we are not driven to defend the introduction of cooking into the public schools as an invasion of the proper field of education, justified by dire necessity. No one can spend an hour in the cooking schools of Boston, as they have been maintained, first through the philanthropic enterprise of Mrs. Hemenway, and afterwards at the expense of the city, without being impressed

by the very high educational value of the instruction given.

As a great object lesson in chemistry; as a means of promoting care, patience, and forethought; as a study of cause and effect; as a medium of conveying useful information, irrespective altogether of the practical value of the art acquired; the short course, which alone the means at command allowed to be given to each class of girls, has constituted, I do not doubt, the best body of purely educational training which any girl of all those classes ever experienced within the same number of hours.

I will mention but a single point. The very large range in the Tennyson-street cooking school was, during the last school year, ready to cook any of the dishes that might be prepared by the pupils, from half-past nine in the morning until half-past four in the afternoon, for five days in the week, for thirty-eight weeks. Fires were made, the dampers and drafts were controlled by the pupils under the direction of the teacher. The amount of coal consumed in this time was considerably less than two tons. Now, if any unhappy householder here present will compare this expenditure of fuel with what takes place in his own kitchen, he cannot fail to be impressed by a sense of the prudence, patience, care, forethought, intelligence, and skill involved in keeping up such a service at so small a cost. If this be not educational, pray what is education? And what is true of this is equally true of all the other exercises in the cooking school, under proper tuition.

THE RELATION OF MANUAL TRAINING TO CERTAIN MENTAL DEFECTS

1895

Read at the Sixty-fifth Annual Meeting of the American Institute of Instruction, July 9, 1895.
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THE RELATION OF MANUAL TRAINING TO CERTAIN MENTAL DEFECTS.

The full title of my paper is: Manual training as an agent in the diagnosis and treatment of certain mental defects; but that statement exaggerates its importance, since what I shall have to say on the subject is merely in the nature of suggestion and inquiry. I have, in fact, no results to announce; no formed conclusions, even, to express. My mind has been drawn within the last few years to certain phenomena which appear to intimate the probability, first, that mental defects, seriously interfering with progress in study and with success in the affairs of life, may exist without being suspected by parents, teachers, or play- and school-mates; secondly, that such defects do in fact exist far more frequently than is popularly supposed. Brought to these conclusions, it has seemed to me that manual training,—or the practice of the mechanic arts as a means of instruction,—while useful in the case of students of normal minds and of the best abilities, may have an additional and most important use as an agent, first for discovering and then for treating, these defects. Let me ask your attention, somewhat at length, to incidents which have suggested the probability that parent and teacher and play- or school-mate have often to do with wholly unsuspected defects of mental constitution and organization.

A few years ago I was called upon to act as the chairman of a committee to examine candidates for West Point, in one of the congressional districts of Massachusetts. The thirteen candidates were subjected to the usual examination for physical soundness; and all satisfactorily passed the test. When we came, however, to the test for color-blindness, a young man whom I had remarked as one of the most spirited, intelligent, and fine-looking of the group, advanced to the table and threw the skeins of colored worsteds into groups so absurd as to seem actually impossible. One moment sufficed to show that he was wholly out of the competition and entirely ineligible for military service. Here was a young man, evidently of more than usual intelligence and ability, who had gone to the age of seventeen or eighteen without any suspicion on his own part that he had not the normal sense respecting color. His parents and the other members of his family from childhood had been accustomed to observe him in his dealings inside the house with colored objects; his playmates had doubtless on countless occasions made reference to the color of objects; and yet he had gone through all this, day after day and year after year, without having his suspicion excited that what they saw he did not see, and he had taken the trouble to prepare himself for an examination the results of which might affect his whole life, without the faintest apprehension of his disability. I remember to have heard of a naval officer who went through the war and was afterwards discharged from the service for a

long-unsuspected color-blindness which was almost total; yet for years he had been dealing with color signals and colored flags and ensigns. It is well known that the color tests introduced by boards of railroad commissioners in several States have resulted in throwing out not a few locomotive engineers of large experience who had never discovered or suspected their deficiencies.

Take another instance: a gentleman came to my office to introduce his son as an applicant for admission to the Institute of Technology. The young man had received an appointment to the Naval Academy at Annapolis; had passed the text-book examination; had passed the ordinary physical examination; had gone through the test for color-blindness; and then it was found that an object which he could see distinctly with one eye at the distance of twenty-seven feet had to be brought within eight feet to be seen at all with the other eye. During all his childhood and boyhood he had never for a moment suspected the existence of this defect. Let me recite still another case. A lady of my acquaintance had very charitably taken into her household, as a servant, a young woman who was subject to severe nervous disorder. She could get employment under no ordinary circumstances; and the lady I refer to had undertaken to carry a part of her burden by employing her. After the lapse of some weeks, this lady, who had often observed the servant very closely and curiously when engaged at her work, especially while sewing, broke out with an exclamation, "Jane, do you really see any-

thing?" The girl looked up in great surprise. "Why, yes, I see perfectly well." Her mistress rejoined, "I do not believe that you see anything as we see it." An examination by an oculist followed; and it was ascertained that the girl's entire disorder proceeded from eyes that were simply a mass of defects and distortions. With treatment of her eyes, the nervous affection in time ceased. I related this to one of the most distinguished medical men in New York, for many years a professor in the College of Physicians and Surgeons, who rejoined: "There are many such cases. My son, a captain in the United States army, for years suffered the greatest agony from pains in his head and the back of his neck, before he discovered that the whole trouble was due to defects of vision."

I might go on for a long time enumerating similar instances which have come under my observation; but what has been said will suffice to justify the inquiry, whether, if such defects, in such degrees, can exist in respect to matters so objective and so completely open to observation and to examination, it is not probable that defects of mental constitution and organization, of the gravest nature, are found in every schoolroom and in every large family; and that much of what the parent or the teacher takes to be the result of indifference, willfulness, or neglect, is due to mental distortions, perversions, obliquities, lesions, and breaches of continuity, which have as distinct and decided an effect in preventing the proper and normal action of the child's mind upon what

is sought to be presented to it, as would the most objective deficiencies and injuries to the organs of sense. If parents and teachers and playmates and schoolmates can fail, through years, to see, or even to suspect, the existence of color-blindness, for example, is it not possible, and even highly probable, that defects more deeply seated and of a more obscure character are the cause of no small part of the failures of the schoolroom?

In connection with the preparation of this paper, a Boston physician has told me of a case recently coming under his knowledge where a young man had gradually become almost totally deaf through the slow process of the disease called adenoids, without his father, a practicing physician, suspecting the existence of the trouble until a late stage of the deafness had been reached. Now, in the case of such a child, whatever is said loudly and distinctly is heard. The moment the teacher's voice drops below a certain point, or her back is turned, or her speech becomes hurried and confused, the child loses all or a part of what is uttered. Some thing he makes out; perhaps by suggestion from what he has caught, perhaps by observation of the teacher's lips or gestures; some other thing he drops entirely; a third thing, still, he gets wrong. The result is partial failure in his work. He does not understand the true cause. His teacher does not suspect it. In the same way, there must be instances of mental defects where a more than usual effort on the part of the teacher, a more than usual degree of attention on the part of the pupil, enable the current of

thought to jump the broken wire and pass to its object; but any slackening of effort on the part of the teacher, or of attention on the part of the pupil, allows the current to become dispersed and to remain without effect.

It is not for a moment supposed that the thought above presented is not familiar to all students of the mind and to all teachers of youth. The only contribution which I can hope to make, is in urging the consideration that mental defects corresponding to the defects in the organs of sense of which illustrations have been given, are vastly more frequent than we have been accustomed to believe and demand greater attention from us in dealing with individual pupils; and, secondly, that we have in manual training an agent for a diagnosis of some, at least, of these defects and, though doubtless in a lower degree, for a treatment of them. We go into an orthopedic hospital and our very souls are torn with the spectacle of distortion and perversion and deformity which we there witness on every hand; but we comfort ourselves by saying, "Thank God! it is only one child in a hundred who is thus afflicted." For my part I believe that the cases of mental distortion, perversion, and deformity are far, far more frequent; and I cannot help believing that it is to such unsuspected disabilities and infirmities of the pupil that we owe a very large part of the failures of the schoolroom which pass for instances of heedlessness, willfulness, and even positively bad purpose.

If, then, it is reasonable to believe that defects of men-

tal constitution and organization, corresponding to defects in the organs of sense, do exist in regard to any large part of our school children, it seems to me clear that we have in manual training, so called,—that is, the systematic practice of the mechanic arts in connection with drawing, as a means of school instruction,—a very important agent, at least for their discovery.

If to the traditional studies we add manual training, we have not only another test of application and capacity—a thing in itself of great importance, inasmuch as, by bringing in a new kind of test, we may largely correct the errors of the test afforded by text-book studies merely—but we have a test peculiarly suited to bring out the cause of any degree of failure in the performance of work. In the first place, the results of good or bad work with tools and upon materials can be measured and gauged and "sized up" with an accuracy which is not attainable in estimating the character of the work done in most of the traditional studies of the schoolroom. The teacher can see exactly in what degree the child has failed, and the child can see it for himself, which is far from being always the case with recitations and examinations. Not only so, but the teacher, as I believe, finds out much more nearly the cause of failure in such work. If there is any tendency to misunderstand instructions and directions; if there are any defects in the child's organs of sense or any broken wires in his mind, a penetrating teacher ought to be able, by repeated experiment, to ascertain the fact. The ob-

jective character of the work, the closeness with which the results can be measured and gauged and criticised, and especially the aid derived by the teacher from the fact that the pupil is almost invariably desirous, and desirous in a high degree, of doing his shop-work perfectly, all these combine, it appears to me, to make certain that a child will not pass through any very long course of study, in a school where such exercises are systematically conducted, without the discovery of any physical or mental defect which may exist. I do not mean to say that in all cases, or even in the majority of cases, the seat of the trouble will be precisely hit upon; but at least enough will be learned to give the pupil fair warning that he does suffer from some disability which he must make special effort to overcome; at least enough will be learned to put pupil and teacher in a better relation of mutual understanding and mutual respect.

Should the manual training exercises disclose defects of mental constitution and organization, I believe that these same exercises may be used by the teacher most directly and beneficially in the treatment of such defects. Even though the teacher should not be so gifted as to be able to make the pupil's work discover the cause of total or partial failure, or of special weaknesses or infirmities, I still believe that the mere practice of the mechanic arts is the best possible regimen and gymnastic to which a mind in any degree falling off from the normal, or suffering from any perversions or deformities, can be sub-

jected. What orthopedic surgery is to the body, such, I believe, manual training in childhood is to the mind. I care comparatively little for its influence upon eye or hand. Its chief work in my view is educational; and in that educational work I place foremost its power of rectifying the mind itself, of straightening the crooked limb,—so to speak,—of strengthening the weak joint, of healing the lesion which, if not cured, will proceed to deep and irreparable injury. Not one of us but has seen seemingly hopeless cases of deformity and weakness in childhood completely cured by the splints, the massage, the fomentations, and the heroic surgery of the orthopedist. As I write, I recall the images of schoolmates and playmates doomed apparently to hopeless suffering and weakness, who are, to-day, by reason of such treatment, straight, vigorous, and comely beyond the standard of their race. A benefit similar in kind can be wrought, I believe, in the case of many children who enter our schools suffering from inherited and acquired defects of mental constitution and organization, by the judicious and intelligent use of the mechanic arts as educational instruments. I am not speaking for the more gifted and fortunate of our pupils, though entertaining the strong conviction that manual training properly applied in schools, freed from the crudities and errors incidental to the introduction of any new system, will prove of great educational benefit to the brightest and best of our scholars. I am speaking for a great body of children who, but for this new instrument of

education in the hands of intelligent and skillful teachers, may go into life with serious mental defects uncorrected, and even unsuspected; defects which will grow more serious and more hopeless with the progress of time and with experience of life.

THE TEACHING OF ARITHMETIC

ARITHMETIC IN THE PRIMARY AND GRAMMAR SCHOOLS

1887

ADDRESS BEFORE THE SCHOOL COMMITTEE OF THE CITY OF BOSTON, APRIL 12, 1887. PUBLISHED AS *School Document No.* 9, 1887.

Largely because of President Walker's vigorous efforts, more rational methods of teaching arithmetic have been followed in Boston during and since his service upon the School Committee.

ARITHMETIC IN THE PRIMARY AND GRAMMAR SCHOOLS.

When I moved, last winter, the resolution which has become the subject of the report of the Committee on Examinations this evening, it was without any purpose of taking part in the inquiry proposed. But the course of public discussion since that time, and my own appointment to the Committee on Examinations, have seemed to require something to be said by me regarding those features of the study of arithmetic in our common schools to which exception has been taken, and which the Committee, through their chairman, have unanimously recommended should be reformed in part or reformed altogether.[1] And, first, it may be said that, if there be any reason whatsoever for believing that the course in arithmetic can be simplified and shortened, the matter is not one of slight importance. The cry of overwork frequently comes from pupils, parents, and physicians who are undoubtedly sincere, even if mistaken in this view; while if we reject the plea of overwork and conclude that the amount of study required of our children is, as an aggregate, not too large, we still have to encounter the almost unanimous complaint of teachers that studies are set down in the official courses which

[1] These recommendations appear, in substance, at the beginning of the following address. See p. 235 *infra*.—Ed.

they have not time to teach as they ought to be taught, many going so far as to say that it would be better that some of these subjects should not be broached at all if they are not to be dealt with more thoroughly and systematically than is possible at present with the time allowed. If, then, the course in arithmetic can be abridged, without injury on that side of our public schools, we know very well what to do with the time so released. It may be applied, in the discretion of the School Board, either to relieve the pupils from the general strain of their work, or to allow the further cultivation of natural science, or to afford additional practice in the art of observation, or to make way for the new mechanical and industrial exercises demanded by so many of our citizens.

Let me not be understood as disparaging the importance of the proper study of arithmetic in our public schools.

No one has a higher appreciation of the vital, practical importance of having our children taught to perform ordinary arithmetical operations with absolute accuracy and with a good degree of facility. Indeed, it is one of the gravest accusations brought against our public schools, as at present administered, that the old-fashioned readiness and correctness of "ciphering" have been, to a large degree, sacrificed by the methods which it is now proposed to reform. A false arithmetic has grown up and has largely crowded out of place that true arithmetic which is nothing but the art of numbers. But to this

point there will be a more fitting occasion to advert further on. The question as to the amount of arithmetical study at present desirable cannot be properly understood without reference to the courses of study in our schools a generation ago. At that time, with the whole week, excepting only Saturday afternoon, at the disposal of the teacher, the studies in the district school were few and simple. Reading, writing, and arithmetic, a little grammar, and a little political geography, made up substantially the course of study. In this condition there was not only no reason to scrutinize carefully the amount of time used for arithmetic, but that study was naturally and properly looked to for a considerable part of the mental training of the child. Increasingly, within the last thirty, twenty, and ten years, new studies in great variety have been introduced into our school courses, some of which are better suited for the purposes of intellectual training than is arithmetic itself.

Thus we have, in addition to the simple political geography of an earlier day, the extended study of physical geography, rising into what were once the mysteries of meteorology.

In illustration of this point, allow me to quote from the official course of study, as revised and simplified in 1885:

Class IV. (Three hours a week).—Second stage of the study of geography. 1. Study of the earth as a globe; simple illustrations and statements with reference to form; size; meridians and parallels, with their use; motions, and their effects; zones, with their characteristics; winds and ocean currents; climate as affecting the life of man (occupations, manners, customs, etc.).

2. Physical features and conditions of North America, South America, and Europe studied and compared; position on the globe; position relative to other grand divisions; size; form; surface; drainage; climate; life (vegetable, animal, human); regions adapted to mining, agriculture, etc.; natural advantages of cities; comparison of physical features and conditions of one grand division with those of other grand divisions. Map-drawing as the study of each grand division proceeds. Other grand divisions to be studied if there be time.

Such are the subjects now prescribed for our children of eleven and twelve years of age. After the completion of this body of study, the child has still three years of geographical study before graduating from the grammar school. Again, we have a large body of elementary science, extended through the nine years of the primary and grammar schools, regarding which I will only quote the curriculum of two years:

Class II. (One hour and thirty minutes a week).—Physiology and hygiene.

1. Growth and renewal of parts of the body, how secured.

(*a*) The digestive apparatus and digestion. Food, the quality and quantity of, etc.

(*b*) Circulation, the organs of. The blood as a circulating medium.

(*c*) Respiration, the organs of. Ventilation. The vocal apparatus.

2. (*a*) The digestive organs of man and other animals, compared. (*b*) Their modes of breathing, compared. (*c*) The amount of animal heat, compared.

Class I. (Two hours a week).—Physics. Common facts learned from observation and experiment, in regard to as many of the following topics as the assigned time will allow: 1, matter, its properties, its three states; 2, motion and force, laws of motion; 3, gravitation; equilibrium, pendulum; 4, lever, wheel and axle, pulley, inclined plane, wedge, screw; 5, liquid pressure; specific gravity; 6, atmospheric pressure; barometer, pumps, siphon; 7, electricity, frictional and current; conductors, magnetism, compass, magnetic telegraph; 8, sound; pitch of sounds, echoes, acoustic tubes; 9, heat; diffusion, effects, thermometers; 10, light; reflection, refraction, lenses, solar spectrum, color.

But these are not all the new subjects to which pupils are now required to give their time and attention. In addition to the old-fashioned "parsing," with an occasional composition, we now have studies in English literature and the history of the English language justifying, it would appear, such questions on examination as "changes in the English language from the time of the Norman conquest to the death of Chaucer,"—a question unknown to the high school and preparatory academy of a generation ago, and even to the earlier years of the college curriculum. Moreover, we have music and drawing pursued systematically and at great length through the entire course of the primary and the grammar school. It is not necessary to take the time of the committee for further enumeration of subjects of study which have been forced into the school week, which, far from being longer than it was a generation ago, is shorter by one-half of Saturday. It is evident that, if so much must come in, something must go out to make room for it; and, secondly, that we have, in these new studies, means for much of that training of the child's powers which our fathers looked to arithmetic to accomplish. "That mathematics," says Sir William Hamilton, "can possibly, in their study, educate to any active exercise of the power of observation, either as reflected upon ourselves, or as directed on the affairs of life and the phenomena of nature, will not, we presume, be maintained." "That they do not cultivate the power of generaliza-

tion," he continues, "is equally apparent." "But the study of mathematical demonstration is mainly recommended as a practice of reasoning in general; and it is precisely as such a practice that its inutility is perhaps the greatest." "Are mathematics then," he concludes, "of no value as an instrument of mental culture? To this we answer, that their study, if pursued in moderation, and efficiently counteracted, may be beneficial in the correction of a certain vice, and in the formation of its corresponding virtue. The vice is the habit of mental distraction; the virtue, the habit of continuous attention. This is the single benefit to which the study of mathematics can justly pretend in the cultivation of the mind."

Such was the opinion of England's greatest philosopher, in this century at least. Reverting, now, to the course of study in the primary and grammar schools of Boston, I do not hesitate to say that some of the new subjects of study, if properly pursued, will not only educate to an active exercise of the power of observation, will not only cultivate the power of generalization, will not only afford excellent practice of reasoning in general, but will also serve to create the habit of continuous attention, as well as or even better than mathematics. Certainly the attention given by a class of interested children in the study of natural history, under a good teacher, is far closer and much more truly educational than the attention given by pupils who are driven reluctantly through an arid waste of mathematics.

I reach the conclusion, then, that not only the demands upon the time of our pupils, but the character of the subjects of study, new to this age, justifies and requires that arithmetic be restricted to that amount which is needed to give facility and accuracy, in ordinary numerical operations, with a view to the use to which this power is to be put, either in practical life, or in subsequent and higher studies. The amount of time now expended upon the study of arithmetic by the revised course is as follows: In the primary school, class 3, three hours thirty minutes per week; class 2, four hours; class 1, four hours thirty minutes. Grammar school, class 6, four hours thirty minutes per week; class 5, four hours thirty minutes; class 4, five hours; class 3, five hours; class 2, four hours thirty minutes; class 1, four hours. During the second half of the last year, two hours and a half additional per week are devoted to the study of book-keeping; but to this I shall not advert.

It appears, therefore, that nearly four hours and a half a week, or almost exactly one-fifth of the entire school-time, are devoted to the study of arithmetic, on the average, during the nine years of school life, according to the prescribed courses. But it also appears, from the results of an investigation made last winter at the instance of this Committee, that this allowance of time is, in many cases, exceeded, in some cases exceeded considerably, during school hours; while it also appears that in thirty-six school districts home lessons in arithmetic are, to a greater or less extent, assigned. It is in the be-

lief that our pupils could acquire all needed facility and accuracy in numerical operations in less than the time now devoted to arithmetic, that the Committee have included in their report two propositions—one, that home lessons in arithmetic shall be given out in exceptional cases only; another, to establish the average time to be devoted to the study of arithmetic at three hours and a half per week. It is my personal belief that this reduction may ultimately proceed even further to advantage, and that the average child could acquire as much accuracy and facility in this regard as would be desired, if properly instructed in simple numerical operations for three hours a week through a term of five years.

At the present time the results in accuracy, if not in facility, of arithmetical work leave very much to be desired. Scarcely has the child been taught to count as high as ten, when he is put at technical applications of arithmetic to money-coins, to divisions of time, space, etc.; and these technical applications are increased in number and in difficulty through the successive years of the grammar school, until for a large amount of so-called arithmetic the pupil gets comparatively little practice in the art of numbers. I am far from saying that the pupils of our public schools should not acquire a certain amount of useful information. The most familiar tables of lengths, weights, measures, and coins may properly be given to them, and they may advantageously be practiced in simple operations thereunder. But this whole matter of the technical applications of arithmetic should

be treated in a highly conservative spirit. Of late years there has been some reform in this particular, and a few of the monstrosities of the old curriculum,—notably our ancient enemy, duodecimals,—have been thrown overboard. But there still remain many things, as taught in our schools, which occupy time that could better be devoted to the study of other subjects, or, at least, to a greater degree of practice in simple operations. The report of the Committee on Examinations contains propositions for a very extensive retrenchment on this side. Compound interest, compound proportion, compound partnership, cube root and its applications, equation of payments, exchange, "similar surfaces," and the mensuration of the trapezoid and trapezium, of the prism, pyramid, cone, and sphere, are proposed to be dropped from the course in the grammar school. If these subjects are to be studied, it should be in the high school. Another change in this direction is in the proposition to remove from the grammar school the study of the metric system.

The Committee believe that, in the present state of our laws and commercial usages, the metric system is a proper subject for extended study in high schools only. The introduction of this subject so widely into the public schools of the United States has been due, not to an appreciation of the practical advantages of this instruction to the existing body of pupils, but to a *propaganda* for the promotion of legislation on the part of Congress and the legislatures of the several States, looking to the gen-

eral adoption of the metric system. The Committee object to having the children of Boston used any longer as an agency for promoting that object, however in itself desirable. Not one child in a hundred, or in three hundred, who has left the schools of Massachusetts during the last ten years, to go to work, has ever once had occasion to use the metric system for any practical purpose. The few who may be called to make use of this system could readily acquire such portions of it as they might need, from their employers or their fellow-employees. In pursuit of the same object, it is further provided in the report of the Committee that all exercises in fractions, commission, discount, and proportion shall be confined to small sums and to simple subjects and processes, the main purpose throughout being to secure accuracy and a reasonable degree of facility in plain, ordinary ciphering. Who of us has not seen in the hands of children of eleven, twelve, and thirteen years of age, examples in "compound and complex fractions" which were more difficult than any operation which any bank cashier in the city of Boston has occasion to perform, in the course of his business, from January to December? The most jagged fractions, such as would hardly ever be found in actual business operations, *e. g.*, $\frac{11}{29}$ or $\frac{13}{27}$, are piled one on top of another, to produce an unreal and impossible difficulty; and the child, having been furnished with such an arithmetical monstrosity, is set to multiplying or dividing it by another "compound and complex fraction" as unreal and ridiculous as itself.

All this sort of thing in the teaching of young children is either useless or mischievous. It is bad psychology, bad physiology, and bad pedagogics. Every pupil, by the time he leaves the grammar school, should be taught to use small sums infallibly, in multiplication and division, and to add columns of figures as long as an ordinary housekeeper's book or bank-deposit book, almost beyond the possibility of ever committing an error. This nearly every child of ordinary brightness can be brought to do, and that in a small part of the time now devoted to the so-called study of arithmetic. It is not necessary that the pupil should be brought to do this thing with rapidity. Only a reasonable facility should be aimed at. If a boy is to go into some line of work where figures are used only incidentally and occasionally, he will have facility enough for the purpose. It is only necessary that he should be infallibly accurate; and this any good teacher ought to be able to secure in five years, seven years, or nine years of drill. If, on the other hand, a boy is to go into a position where his main work is to be concerned with figures, he will readily enough acquire the necessary facility, if only accuracy has been secured during the years of especial mental growth and training. If, however, his training has been loose and unsystematic, no amount of practice will give him accuracy; the faster he works, the more mistakes he will make. Nor is it easy, if, indeed, it be at all practicable, to remedy the defects of early education in the case of one who has passed the age of fifteen or

sixteen without that training and drill in the use of figures which would make mistakes in simple operations almost impossible.

Unfortunately, in this matter of inaccuracy in the use of figures, resulting from the manner in which arithmetic is now taught in our schools, the evidence is overwhelming in character and amount. Our technical schools receive pupils from the high schools who, while they understand difficult theorems, and are masters of complicated algebraic formulæ, make mistakes in the simplest arithmetical operations. If the high schools are blamed for this, the masters justify themselves by alleging that pupils come to them—as a high-school teacher said to me within two weeks—without being able to add or multiply, to subtract and divide, or even to count, with accuracy.

The grammar-school masters, if appealed to, are obliged to admit the deficiencies of their graduates; but they ask, what better can be expected when only a small fraction, often a contemptibly small fraction, of the time nominally devoted to the study of arithmetic can be given to numerical operations, consistently with bringing their pupils up to the bar, duly loaded and primed for examination in countless technical applications of arithmetical rules, and consistently with giving them that flexibility for the purposes of arithmetical gymnastics which the practical and illustrative problems of the text-books require?

But it is not alone the teachers of the high schools

who have occasion to complain of the way in which the study of arithmetic is conducted under the prevailing system. The employers of those boys and girls who leave the grammar school to go to work, have occasion to complain, and do complain bitterly, of the deficiencies of our instruction on this side. After very extensive inquiries, conducted through the past year, I do not find it possible to entertain a doubt that the old-fashioned facility and accuracy in ciphering have been largely sacrificed to the numerous technical applications and difficult logical puzzles which have been introduced into the instruction in arithmetic, and that our children leave the schools very ill-prepared, in this respect, for the practical work of life. Now, it is difficult to imagine a greater wrong, short of a permanent injury to health, that can be done to a child, than to send him into the world to earn his living without the ability to conduct numerical operations accurately and with reasonable facility. Employers have, literally, no use for boys who make mistakes in numbers. Such a failing offsets the best training otherwise of mind and hand.

In a store or shop or factory, or on a railroad, a lad who cannot set down figures and add them right every time is little better than a cripple. The master of one of our high schools told me recently of having been informed by the president of a Boston bank that, at an examination held during the year with reference to an appointment in his institution, out of several graduates of various high schools of this vicinity not one was found

able to add the columns of figures given to him, without errors. It is little wonder that this should be the result, when, of the time devoted to arithmetic, four-fifths or nine-tenths is occupied by technical applications of numerical principles, or is worse than wasted by logical puzzles unsuited to the child's age and mental strength.

And this last remark brings me to the hardest accusation which is to be brought against the current teaching of arithmetic. Well aware that at this point we have to encounter an inveterate superstition of the New England mind, I have armed myself as much as possible with authority derived from men of the ripest wisdom and the largest learning in mental science. The charge I make against the existing course of study is that it is largely made up of exercises which are not exercises in arithmetic at all, or principally, but are exercises in logic and, secondly, that, as exercises in logic, these are either useless or mischievous. The class of exercises that is here in mind will be easily apprehended. It is of those where an example, or so-called practical problem, is given in figures and words, which are to be reduced to the form of figures and algebraic signs, and thereupon the performance of the indicated numerical operations will yield the required result. It would, perhaps, be going too far to say that such examples should in no case be given; but it may be unhesitatingly asserted that wherever the "statement" which is preliminary to the performance of the purely arithmetical

operations involves a great deal of trouble, time, and thought, while the mere ciphering which follows is done in a minute, such exercises, as a matter of course, are not exercises in arithmetic, but in logic.

Secondly, if such exercises, of any considerable degree of difficulty, are to be set at all for the pupils in our public schools, they should be prescribed as exercises in logic, or the art of reasoning; they should be taken from books prepared by eminent teachers of the science of mind who are qualified to decide as to the degree of difficulty in logical exercises which is suitable to the child of this or that age; and the exercises so prescribed should be conducted by persons themselves trained and qualified to teach the art of reasoning. To smuggle exercises of this character into instruction given in the name of arithmetic, is an abuse. By it has been created a bastard arithmetic which fails to perform the true function of that study in our public schools—namely, to produce accuracy and a reasonable degree of facility in numerical operations—while wasting the time of the pupils,[1] perplexing their minds, worrying their

[1] In scarcely any branch of study is it possible to absolutely waste so much time as in arithmetic. In history or geography, for example, the more time the pupil spends over his books the more, speaking generally, will he learn. What he learns may be of little value; but he will certainly, in a greater number of hours, acquire a greater number of names, facts, and dates. In arithmetic, however, almost any amount of time and nervous force may be made a dead loss, if the logical puzzles presented to the pupils, under the name of practical problems, are above the pupil's comprehension. After the child has read over the problem again and again, without understanding it, without seeing the principle and processes involved, and

tempers, rasping their nerves, and, in case of total or partial failure, unnecessarily and unrighteously shocking and impairing their self-respect and scholarly ambition.

Does anyone consider this an extravagant denunciation of exercises of the character indicated? I ask, is there any father who has had children in the public schools of Boston, where arithmetic is used as a home lesson, who has not seen those children puzzling and worrying ten, fifteen, or twenty minutes over a "practical problem," the purely numerical work of which would not occupy as many seconds; and, after an evening spent in this way, going to bed hot, tired, and perhaps tearful, and altogether unfitted for that sound and healthful sleep which should close every child's day? I have myself had four children in the grammar schools of this city or of New Haven, where home lessons in arithmetic were allowed. Each one of these in turn I have seen tormented in this way; and have myself, not infrequently, when stooping to aid them, that they might go to bed in something like Christian season, been not a little perplexed and troubled to make the statements required. Doubtless this has been the experience of most parents; and doubtless, too, this practice would

has made one or two hopeless efforts towards its solution, it does him no good whatever to keep on worrying over it. The exercise ceases to have any educational value, and becomes merely a means of nervous exhaustion.—*From President Walker's Reply to Supervisor Peterson in the Boston School Committee. Published in "Primary Education," September*, 1887.

long since have been reformed, but for the inveterate superstition of the New England mind that it is well the child should be worried and perplexed in education, and that out of this agitation of the nerves and this strain upon the mental powers proceed health and vigor.[1] Such a view is everywhere yielding to a better study of the laws of mind. Generally, if not universally speaking, whatever in education is hard is wrong. The true mental gymnastic for growing children is through exercises easy and pleasant which lead insensibly up to ever

[1] A generation ago it was the accepted theory of educators generally, that instruction, to be most effective, should cross the grain of the youthful mind; that if disinclination were shown towards any particular study, the teacher should catch at this as his welcome clew; and that the scholar should thereafter be practiced and drilled, for his mind's good, against his indifference, his dislike, and even his repugnance, until he should learn to do well and freely that for which he had originally the strongest inaptitude. In a word, indisposition towards any kind of mental exercise was to be dealt with like a sinful inclination; war was to be made upon it until it should be conquered.

Not only a better observation of life, but the study of physiological psychology, has led the educators of to-day to a widely different view of the office of instruction. It is now generally admitted that it is the first duty of the teacher to ascertain the true bent of the youthful mind, and that, so far as practicable, instruction should be made to conform thereto; that the successful teacher is not the one who compels the scholar to do, at the last, reasonably well that which he was at the first least disposed to do, but the one who brings the scholar to do, in the fullest degree and in the most perfect manner, that for which he has the greatest aptitude, leading him, with ever increasing freedom and pleasure of work, in the ways which nature has pointed out; that in any other system of training there is enormous and irreparable loss of nervous force and moral enthusiasm, with a result certain to be lower and less desirable than under the system which seeks to develop to their highest efficiency the native powers of the mind.—*From Annual Report as President of the Massachusetts Institute of Technology*, 1883.

higher planes of attainment, as the faculties are expanded and strengthened according to their own law of growth, aided and fostered by gentle and agreeable practice.

It is in my power to present to the committee the results of an experiment on a sufficiently large scale to establish the truth of these representations regarding the difficulty of many of the sums and problems set for the pupils of our public schools. Fourteen examples, taken from the arithmetic in use in our schools, were given out to a large number of pupils of the three upper classes in four of our grammar schools. These examples were not the most difficult which could have been taken for the purpose. On the contrary, a number of the examples first selected were thrown out upon the representation of the masters that they would be found so difficult as to produce a general failure. The following represents the percentage of successful answers in each case:

Example.	Per Cent.	Example.	Per Cent.
1	69	8	53
2	16	9	65
3	47	10	38
4	67	11	49
5	46	12	51
6	56	13	70
7	86	14	39

But it is not merely to the degree of difficulty attaching to exercises of this character that exception should be taken. I desire to challenge peremptorily the whole policy of giving out exercises of any appreciable degree of logical difficulty to children of this age. Thoroughly

convinced that such a practice involves, to repeat the phrase already used, bad psychology, bad physiology, and bad pedagogics, I was yet desirous of bringing to my support the authority of masters in mental science, and, with this view, addressed communications to Professor William James, professor of psychology in Harvard University; Professor George H. Howison, professor of philosophy in the University of California; Dr. G. Stanley Hall, professor of pedagogics in the Johns Hopkins University,[1] and Dr. Noah Porter, late president of Yale College, and still professor of mental and moral science in that institution. The purport of these communications was to inquire, first, whether the faculty of logical analysis is not one which, in the case of the vast majority of children, normally develops at a later period than that within our present consideration; secondly, whether if this be so, there is any pedagogical advantage in attempting to "pry up" this faculty and bring it prematurely into consciousness and exercise, instead of devoting the time and strength of young pupils to the formation of a habit of observation, to the cultivation of the powers of perception, to practice in the interpretation of personally observed phenomena, to the acquisition of elementary information, and to the development, in a reasonable degree, of strength and clearness in the memory. The class of exercises to which exception has been taken were illustrated either by sufficient description or by actual examples. To these communi-

[1] Now President of Clark University.—Ed.

cations the most courteous replies have been received. The essential parts are here submitted, without apology for their length, on account of the great interest of the subject treated, and the high and commanding reputation of the authors.

Professor James writes: "The elaborate combinations of arithmetical data of which you write are certainly given to children before their brains are very hot for them; while I imagine, on the contrary, the mere operations of arithmetic are a comparatively congenial exercise. It is, as you say, in the association of concretes that the child's mind takes most delight. Working out results by rule of thumb, learning to name things when they see them, drawing maps, learning languages, seem to me the most appropriate activities for children under thirteen to be engaged in. Anecdotal history (without political ideas) might be added. I feel pretty confident that no man will be the worse analyst or reasoner or mathematician at twenty for lying fallow in these respects during his entire childhood."

Professor Stanley Hall writes: "If I correctly understand your position, I most emphatically agree with it. The purer the mathematics for boys of from ten to fourteen years of age, the better, it seems to me. Many of our arithmetics presuppose algebra and geometry; *i. e.*, in the latter part give examples that can be done easily by those methods, but which require students to go through long and tedious processes which algebra and geometry were meant to short-circuit. Problems in

brokerage, surveying of land, architecture, custom-house practices, etc., are taught, just as in the old Hindoo mathematics a taste for poetry, and in mediæval arithmetics moral and religious maxims, and even systems, as well as historical information, were inculcated in the form of 'sums.' Has modern business really any more place at that stage? . . . American teachers seem to me to have spun the simple and immediate relations and properties of numbers over with pedantic difficulties. The four rules, fractions, factoring, decimals, proportion, per cent., and roots, is not this all that is essential? The best European text-books I know do only this, and are in the smaller compass, for they look only at facility in pure number-relations, which is hindered by the irrelevant material publishers and bad teachers use as padding."

Professor Howison writes: "I understand your question to bear simply on the point whether I consider the class of arithmetical exercises, to which you refer, and in which the work turns almost entirely on the logical relations of the numbers given in each example, to be a wholesome *regimen* for pupils in the common schools, of ages from eleven to thirteen years. To this I reply, first, that on general principles such exercises in reasoning upon the combinative relations of numbers, or numbered objects, ought to play a very subordinate part in the elementary period of instruction of arithmetic. But nevertheless, secondly, as the very life of arithmetical power turns on ability to make the logical synthesis in-

volved in the latter kind of work (you see, I do not reckon them mere analyses, as is usually done), I think some exercises of this sort should go along with the other simple and more natural kind, and that they should go from the earliest practicable date, almost from the beginning. But the combinative reasoning should be adjusted in the most careful and considerate manner, with a reference, that is, to the degree of difficulty with which the mind of a child is able at each date to cope, without confusion, and without sense of shame. So, thirdly, I should say that the question you raise concerns, mainly, a matter of more or less—a matter of degree. It is not that the class of exercises to which you refer are in kind and of necessity wrong, but that the complexity and difficulty of those actually given are so often out of all proportion to the healthy capacities of children at the age involved. . . My own experience and opinion of many details in the arithmetics made for boys and girls of the age to which you refer are quite like yours. And my experience and my theories, founded on my professional studies and practice, have alike made it, with me, a matter of settled conviction that not only in mathematical, but in all elementary teaching, though in elementary mathematical teaching pre-eminently, the first thing is to get the pupil perfectly familiar with, and as nearly as possible infallibly accurate, in fundamental facts and operations. . . I believe our current practice in this reference has for some years—say the last thirty—been going seriously wrong.

The reaction from the exaggerated rote-work of the preceding period has driven us into the error of the opposite extreme.

"The attenuated thread into which grammar-school instruction is now 'long drawn out' should appear a patent absurdity to every thinking mind. Particularly is this absurdity manifest in the fact that we spend eight or nine years in nominally teaching arithmetic, when we ought to be able, surely, to accomplish all that is essential in three, or, at the very utmost, in four."

President Porter writes: "I am entirely with you in the opinion that the questions which you send me are unfit for pupils of fourteen or fifteen years, unless they have been subjected to a special training; and that to subject persons of that age to such a training would ordinarily do them more harm than good. . . Nothing is so admirable, in its time and place, as the pure mathematics in every form. When these are properly taught, *i. e.*, when they have trained the mind to sharp analysis and patient synthesis, by the use of numbers and geometric forms, they prepare the way for the higher forms of logical analysis and synthesis, and, last of all, for invention—the invention which is presupposed in the problems to which you reasonably object."

It is for the reasons which have been given, reenforced by the authority of the eminent teachers who have been cited, that the Committee have included in their recommendations a rule which would require that all practical and illustrative problems should be of a

nature to interest and to aid the pupils in their strictly arithmetical work, not to throw obstacles in their way or to increase the difficulty of that work; it being expressly provided that all problems where an attentive and diligent pupil of ordinary capacity would find any considerable degree of difficulty in making the "statement" preliminary to the performance of the numerical operations required, shall be deemed objectionable.

ARITHMETIC IN THE BOSTON SCHOOLS
1887

Address before the Grammar-School Section of the Massachusetts Teachers' Association, November 25, 1887. From *The Academy*, January, 1888.

ARITHMETIC IN THE BOSTON SCHOOLS.

Near the close of the last school year, the School Board of Boston passed the following orders concerning the study of arithmetic:

1. Home lessons in arithmetic should be given out only in exceptional cases.

2. The mensuration of the trapezoid and of the trapezium, of the prism, pyramid, cone, and sphere; compound interest, cube root and its applications; equation of payments, exchange, similar surfaces, metric system, compound proportion, and compound partnership, should not be included in the required course.

3. All exercises in fractions, commission, discount, and proportion should be confined to small numbers, and to simple subjects and processes, the main purpose throughout being to secure thoroughness, accuracy, and a reasonable degree of facility in plain, ordinary ciphering.

4. In "practical problems," and in examples illustrative of arithmetical principles, all exercises are to be avoided in which a fairly intelligent and attentive child of the age concerned would find any considerable difficulty in making the statement which is preliminary to the performance of the proper arithmetical operations.

When arithmetical work is put into the form of practical or illustrative problems, it must be for the purpose

of interesting and aiding the child in the performance of the arithmetical operations, and with a view to their common utility.

5. In oral arithmetic no racing should be permitted; but the dictation should be of moderate rapidity.

6. The average time devoted to arithmetic throughout the primary- and grammar-school course should be three and a half hours a week; and in the third primary grade, not more than two hours, and in the first and second primary grades, not more than three and a half hours each per week.

It is the purpose of the present paper to state the considerations, as I conceive them, which moved and guided the School Board in taking the action recited.

The inhibition of home lessons in arithmetic stands upon somewhat different ground from the other orders of the committee. It might fairly be asked why arithmetic should not be put upon the same level with geography or grammar or history or physiology, as a possible and proper matter for home lessons, if, indeed, home lessons are to be assigned at all. In answer to this question, I may say that the committee which recommended the rule recited were actuated by three considerations.

First—The committee, having become satisfied that there is a tendency unduly to magnify the importance of arithmetic on the part of many grammar-school teachers, and to allow that subject to encroach alike upon the time which should be devoted to other subjects of study and upon the time which should be given to recre-

ation, exercise, and rest, deemed home lessons by far the most likely avenues for such encroachment, and therefore prohibited their use in connection with this branch of study, save only in cases clearly exceptional, as, for instance, when a pupil has for some time been absent from school and has, consequently, back work to make up.

At this point it may be not inappropriate to remark that careful inquiry of the superintendent and the supervisors of schools failed to elicit the faintest evidence that better results in arithmetic were, as a rule, attained in schools where home lessons in this branch were habitually given out to the pupils of one or another or of all the three upper classes, than in schools where no such lessons were assigned. The reasons for such an apparent waste of the time and force expended upon home lessons in arithmetic will, I think, abundantly appear in the further course of this discussion.

Secondly—Arithmetic, as the subject matter of home lessons, affords peculiar opportunities for doing injustice as between pupil and pupil. In some degree such injustice will be done whenever the work of the pupil is transferred from the schoolroom, where all have equal advantages as to light and air, quiet, and the individual attention of the teacher, to their homes, where the widest possible range exists as to the conditions under which the work shall be prosecuted. One pupil takes his "sums" to a quiet study-room, well lighted and warmed; another pupil takes his task back to a home where it is to be per-

formed amid noise and squalor, by an inadequate and doubtful light, perhaps with half-a-dozen children in the same room, possibly with drinking and smoking going on. Such a range of conditions would apply equally to all subjects taken for home lessons, but it would produce a far greater effect in the case of arithmetical tasks, requiring a peculiar degree of abstraction and attention, than in that of almost any other subject.

Of even more importance, in this connection, is the consideration that the parents of some pupils are capable of helping them to the solution of their problems and are very likely to do so if the work is seen to be too difficult, while other parents are entirely incapable of giving any assistance to their children no matter how heavily they may be taxed by the tasks assigned. It goes without saying that such an inequality of conditions would produce far less injustice, as between pupil and pupil, if history, geography, grammar, or physiology were the subject matter of the home lessons.

Thirdly—The last and most conclusive of the considerations against home lessons in arithmetic is that the absence of the master prevents any authoritative interposition to put a stop to the business when, even according to the standards of the most ardent advocates of pedagogic torture, it has already proceeded far enough. In the old flogging days of the army and navy, it was always required that the surgeon should stand by, to feel the pulse of the poor wretch under the lash, to watch the signs of approaching nervous collapse, and, in his dis-

cretion, to forbid the punishment to proceed further. But in the case of our young children to whom home lessons in arithmetic are assigned, no such humane provision exists. Were the work being done in the open schoolroom, the severest master, when he saw that the child did not understand the problem, could not do the work, and was only becoming more excited and fatigued by repeated attempts, would interpose either to give assistance or to put a stop to the exercise. In the case of home lessons, however, an ambitious and sensitive child finds no such relief. The work may go on long after the child should have been in bed, until a state is reached where further persistence is not only in the highest degree injurious but has no longer any possible relation to success. The boy or girl, hot, tired, overwrought, quivering with distress, could no more do "the sum" in such a condition, than he or she could "put up" a hundred-pound dumb-bell. Yet the remonstrances of parents produce only fresh tears, and when at last authority is exerted and the child is driven to bed, utterly unfitted for that sound and refreshing sleep which should close every child's day, the task is still unperformed. Over and over and over again have I had to send my own children, in spite of their tears and remonstrances, to bed, long after the assigned tasks had ceased to have any educational value and had become the means of nervous exhaustion and agitation, highly prejudicial to body and to mind; and I have no reason to doubt that such has been the experience of a large pro-

portion of the parents whose children are habitually assigned home lessons in arithmetic.

Such were the considerations which induced the committee to pass the first order which has been read in your hearing.

Regarding the remaining five orders, considered as a body, it may be said that the committee in framing them were actuated by the belief, formed partly through their individual experience and observation of public school instruction, and partly as a result of an investigation conducted by the committee in pursuance of an order of the School Board under date of April 27, 1886, that both loss of time and misdirection of effort, with even some positively injurious consequences, were involved in the teaching of arithmetic as carried on in some of the Boston schools. And here let me say, to prevent misapprehension, that the committee at no time intended to reflect on the schools of our own city as compared with those of neighboring cities and towns. Personally, I believe that the teaching of arithmetic has been more humane and rational, of late years, in the schools of Boston than in those of most New England towns and cities.

What, then, are the faults complained of?

First—That the amount of time devoted to this study is in excess of what can fairly be allotted to it, in the face of the demands of other and equally important branches of study.

Secondly—That the study of arithmetic is very

largely pursued by methods, supposed to conduce to general mental training, which, in a great degree, sacrifice that facility and accuracy in numerical computations so essential in the after-life of the pupil, whether as a student in the higher schools or as a bread-winner.

Thirdly—That, as arithmetic is taught in many—perhaps in most—schools, the possible advantages of this branch of study, even as a means of general mental training and of the development of the reasoning powers, are, whether by fault of the text-book or of the individual teacher or of the standards adopted for examination, largely sacrificed through making the exercises of undue difficulty and complexity, the exercises prescribed often reaching a degree of difficulty and complexity which not only destroys their disciplinary value but becomes a means of positive injury.

The three propositions just recited, I will, with your indulgence, take up in consecutive order.

First—The estimation in which arithmetic is held, alike by the general public, by school boards and committees whose duty it is to lay out and arrange the course of study, and by the teachers who, enjoying more or less freedom of action, are to carry the prescribed schemes of instruction into effect, is very largely a traditional one. The recognition of changed circumstances and conditions, the persistent intrusion of new demands and requirements arising out of those changes in condition and circumstance, have, indeed, caused both the official and the popular estimation of arithmetic to be more or

less fully revised and modified. Yet, so strong is the force of tradition, especially in the school system, where the pupils of one generation become the teachers of the next, that we cannot too carefully inquire whether the reasons which at one time underlay this or that part of our scheme of instruction have not disappeared.

The objects sought in teaching arithmetic to the children of our public schools are two. First, foremost, and absolutely indispensable, is the acquisition of the ability to perform simple numerical operations with reasonable rapidity and with almost infallible accuracy. Greatly as children differ on the side of their minds concerned in these operations, there should be yet no difficulty in securing the above result in the case of all but a very few persons who may perhaps, for school purposes, be regarded as hopelessly indisposed toward numbers. Probably every one of these last cases would in time yield to judicious individual treatment; but, as children have to be dealt with in large classes, we must accept a small proportion of failures, in this respect, as inevitable.

What is the standard which should be set up for attainment in arithmetic, having reference only to the practical value of that attainment in after-life? I answer, 1st, the ability to count infallibly objects occurring irregularly, up to two or three hundred, say, for example, packages of tickets or checks, dots upon a piece of paper, persons in a small audience room, etc.; 2d, the ability to add, without the possibility of a mis-

take, columns of figures such as would occur in an ordinary savings-bank deposit-book or housekeeper's pass-book; 3d, the ability to add two numbers, each below one hundred, or to subtract the less from the greater, rapidly and without recourse to pen or pencil; 4th, the ability to multiply, on the slate or blackboard, one number of moderate length by a small multiplier, or to divide it by a small divisor; 5th, the ability to compute simple interest, on moderate sums, at even rates per cent., for round periods; 6th, the ability to work simple examples in "Reduction," involving the use of the American tables of weights, measures, and moneys.

If every boy and girl, on leaving the grammar school, at fourteen or fifteen, had reached this stage of attainment, the public schools would have fairly done their duty by them, so far as the practical uses of arithmetic are concerned. This is all I would ask for my own son or daughter. This is as much as nineteen boys out of twenty, ninety-nine girls out of a hundred, who do not go beyond the grammar schools have occasion to put frequently to use in the work of their lives. If the twentieth boy is to be a clerk or accountant or to take up business for himself, he will, very readily, from this basis, acquire the needed facility in casting up the columns of a ledger, or in working heavier sums in multiplication or division.

This is the first object to be sought through the study of arithmetic; and its importance has neither increased nor diminished since the days of our fathers.

The second object which is properly sought by means of the studies and exercises in question is general mental training.

The importance of this function of arithmetic has greatly declined during the present generation by reason of the introduction of new studies and exercises, some of which are equally well adapted, if, indeed, not better adapted, to perform the required work. Thirty and forty years ago, the studies in our public schools were few and simple. Reading, writing, and arithmetic, a little grammar, some crude declamation, with political geography, made up, substantially, the course of study. Of the physical geography of to-day, extending even to what were once the mysteries of meteorology, taking into account the influence of currents of air and water upon climate, and of climate upon the productions of the soil and upon the occupations of man, there was then not a trace. History and civil government were unknown studies in the grammar schools of those days. Physiology was just about to enter the schools, in spite of the protest of an eminent citizen of Massachusetts upon the ground that it was one of a group of sciences none of which should be brought into the schools unless all were to be. Music and drawing were to wait still longer for recognition by school authorities. The elementary mechanics and physics, so successfully taught in many schools, were then not dreamed of as possible subjects of study. A district schoolmaster of the past generation would as soon have thought of teach-

ing the language of Archimedes as of explaining the principle of the lever and fulcrum.

The introduction of many new subjects of study has greatly reduced the importance of arithmetic as a means of general training. In the generation just passed, it was necessarily looked to for very much of the development and discipline of the pupil. To-day a half score of separate sciences or important subjects of study offer themselves to do the same work, in one or more of which are unmistakably found all the educational virtues which belong to arithmetic, together with others which arithmetic does not possess. The strongest claim made in behalf of mathematical study has been its cultivation of the power of continuous attention; yet the degree of attention which can be commanded, on the part of children dragged reluctantly through compound fractions or cube root, is far inferior to that given by a group of eager boys and girls following an enlightened teacher in some branch of natural history. Generally speaking, it may be said of the new subjects, that, while they train the powers of reasoning not less efficiently than does arithmetic, they also bring into play the powers of perception and observation which in all branches of mathematics are left absolutely unused.

I would not wish to be understood to assert that arithmetic has ceased to have any educational value at all, beyond its practical utility, in the public school of to-day. I entertain no doubt that, in the primary school and even the lower classes of the grammar school, number-

lessons, in application to concrete objects, may be helpful in awakening interest, arousing thought, and bringing the mind into healthful exercise; but I do seriously question whether for every hour spent by a boy of thirteen or fourteen years of age in the study of arithmetic, beyond what is necessary to secure the degree of accuracy and facility indicated at an earlier stage of the discussion, an hour spent in some other kind of study might not be substituted to his very great advantage. However this may be, it seems to me clear that arithmetic, by virtue of having been earlier on the ground and of enjoying the prestige and authority derived from the past, continues to-day to occupy space which is urgently needed for the proper extension of some of the new subjects that, in spite of the recognition of their practical utility and educational value, have scarcely been able to secure a foothold in fact, although forming a feature of the grammar-school curriculum on paper.

The second of the main propositions laid down was that the study of arithmetic is very largely pursued by methods supposed to conduce to general mental training which, in a great degree, sacrifice that facility and accuracy in numerical computations, so essential in the after-life of the pupil, whether as a student in the higher schools or as a bread-winner.

That the results of the study of arithmetic in the grammar schools are unsatisfactory, so far as the ability of the pupils to perform numerical work correctly and with reasonable dispatch is concerned, whether in subse-

quent studies or in actual business operations, seems to me established by abundant testimony, both of merchants, manufacturers, and bankers, receiving graduates from our grammar schools, and of teachers in higher institutions of learning. The average pupil falls short of the very moderate degree of attainment which I indicated as fairly to be expected from all but a very few highly exceptional scholars, and that too with very much less than the amount of time actually devoted to arithmetic. The head masters of both of the great high schools of Boston have assured me that they find grave deficiencies on the part of large numbers of pupils coming from the grammar schools, in this matter of accuracy in simple numerical operations; and I have received similar information from the head masters of high schools in other cities. In the institution with which I am personally connected, instructors in algebra, for example, find that many pupils who are familiar with difficult theorems and are masters of complicated formulæ, often vitiate their work by simple numerical mistakes, such as would have been impossible had they been properly trained in the earlier stages of their mathematical education. Professor Safford, the eminent mathematician and astronomer of Williams College, in a recent treatise states that he finds in his own pupils a great want of skill in ordinary calculations and that inaccuracy in simple arithmetical work is very common. In a letter which I have to-day received, Professor John E. Clark, the head of the mathematical department of the Sheffield Scientific School of

Yale College, states very strongly the deficiencies of students entering that school, in the matter of simple numerical accuracy and facility.

Embarrassing as are such deficiencies in the case of students pursuing long courses of study, the results in the case of those students who leave the grammar school to begin to earn their own living are in a high degree disastrous. To repeat here language which I have used elsewhere: employers have literally no use for boys who make mistakes in numbers. Such a failing offsets the best training, otherwise, of mind and hand. In a store or shop or factory, or on a railroad, a lad who cannot set down figures, and add them right, every time, must take and keep an inferior position. It is difficult to imagine a greater wrong, short of a permanent injury to health, that can be done to a child than to send him out into the world to earn his living without the ability to conduct numerical operations accurately.

The defect which has been thus severely commented on is not due to a lack of time devoted to exercises under the name of arithmetic, but to the fact that so little proper numerical work is involved in these exercises. Scarcely has the pupil learned the four simple rules before he is given numerous technical applications requiring the use of extended tables of weights, measures and moneys, and so-called practical or illustrative problems which necessitate deep and long puzzling over the relations and terms involved. Even in the early stages of this process, seldom is so much as one-half of the time

given to proper numerical work. Often that proportion sinks to a third, or a quarter, or even to a smaller share. Sometimes the amount of such work becomes inconsiderable. Who of us has not seen a bright lad spend ten or fifteen minutes over a practical problem, when the mere addition, multiplication, subtraction, and division involved would not have occupied as many seconds?

It was partly to increase the amount of actual numerical work to be done in an hour devoted to so-called arithmetic; in part, also, to reduce the load which our children are required to carry all the time on their minds, ready to be at any instant unpacked and put to use, that the School Board of Boston have thrown overboard the large and miscellaneous "lot" of subjects mentioned in their second order. It was with reference in part to the consideration just indicated, and, in part, to that consideration which remains now to be stated, that they passed the orders numbered three and four.

The third and last of the main considerations which actuated the School Board, dealing with this subject, has been stated as follows: That, as arithmetic is now taught in many, perhaps in most, schools, the possible advantages of this branch of study as a means of general mental training, are, whether by fault of the text-book or of the individual teacher or of the standards adopted for examination, largely sacrificed, through making the exercises of undue difficulty and complexity, the exercises prescribed often reaching a degree of difficulty and

complexity which not only completely destroys their disciplinary value, but becomes a means of positive injury.

It was in the belief just stated that the Board prescribed that all exercises in fractions, discount, commission, and proportion should be confined to small numbers and to simple subjects and processes; and, again, that in so-called practical and illustrative problems, all exercises in which a fairly intelligent and attentive child of the age concerned would find any considerable difficulty in making the "statement" which is preliminary to the performance of the proper arithmetical operation, shall be deemed objectionable.

This action of the school committee was at the time opposed, and is still by some criticised, on two different grounds. One, that the exercises given to the children in the Boston schools, whether as examples under the rules mentioned or as practical and illustrative problems, have, in fact, uniformly been simple and easy; the other, that, in sound educational theory, the exercises given to young pupils ought to be difficult, complicated, perplexing, and distressing, in order that the child's mind and spirit may undergo a due preparation for the difficult duties and hard problems of life, one enthusiastic writer of this school going so far as to declare that it is essential to good education that the sums set for the pupil should be not only often difficult but sometimes actually impossible of solution by him, in his then stage of mental development.

To the assertion, so constantly made, as to the simple

and easy character of the exercises prescribed for our children, it may be replied that, if the facts are as stated, the rules imposed can do no harm; but that the personal testimony of members of the Board abundantly establishes the fact that absurdly complicated exercises in fractions, cube root, etc., and practical problems amounting to the severest logical puzzles, were given out, in some of the schools of Boston, down to the very date of the order recited.

As to the educational theory which was brought to bear, both in debate and in outside criticism, against the proposed rules, I may say it is pleasure to encounter error with so little of disguise. If its advocates are in the right, the action which the school committee have taken is, of course, all wrong; but I, for one, do not hesitate to assert that this theory, in its milder form, is inconsistent with the best and ripest results of modern physiology and psychology; while I denounce that theory in its extreme shape as a relic of barbarism, closely akin to some of the most savage superstitions of primitive mankind. The notion that exercises, either mental or physical, prescribed for young children, should be often up to the full limit of their powers and should at times exceed those powers is distinctly false. The true gymnastic for the growing child is through exercises easy and pleasant, which lead insensibly up to ever higher planes of attainment, as the faculties are expanded and strengthened, according to their own law of growth, through gentle and agreeable exercise.

Wherever fatigue, confusion, and the sense of strain begin, there the virtue of the exercise ceases, whether for promoting the growth of the powers or for the training and disciplining of the powers as they exist. Loss and waste—it may be much, it may be little—begin at this point, and go forward, from this point, at a constantly accelerating ratio.

In college, thirty years ago, those of us who were given to athleticism were accustomed to use heavy dumb-bells, the heavier, we thought, the better. Twenty-four and thirty-two pounders, the famous "fifty-sixes," and even eighty-pound bells were much in favor with young fellows who desired to become strong. To-day, a prize fighter preparing to contest the championship of the world uses, habitually, very light dumb-bells, just heavy enough to give a purpose to his blow and to be distinctly felt at the end of the stroke. He makes, with the light bell, ten strokes to one he would make with the heavy bell, and gets twice as much good from the exercise. If this be the part of wisdom for the grown giant, overflowing with the exuberance of his strength, much more is such a course desirable in the case of young, tender children, yet in the gristle, the frame and brain still plastic and yielding, with the possibilities of manhood and womanhood but dimly intimated. Whether for the promotion of future growth, or for the training of the powers as they are, or for the acquisition of the inestimable art of rapid and accurate computation, school exercises in arithmetic should, in

the opinion of the Boston Board, be easy and simple, with the resulting advantage of becoming more frequent than is possible, within any reasonable limits of time, in the case of the highly complicated and difficult sums and problems with which the traditional gymnastic deals.

The greatest enemy, however, to true arithmetical work is found in so-called practical or illustrative problems, which are freely given to our pupils, of a degree of difficulty and complexity altogether unsuited to their age and mental development. It is bad enough to give boys and girls of twelve and fourteen years of age numerical operations far exceeding in difficulty those which any bank cashier has to perform from one year's end to another; to require them to extract the cube root of three-sevenths; to pile one irregular and jagged fraction on top of another and then ask them to divide or multiply this by an arithmetical monstrosity as hideous and impossible as itself. But, at least, a pupil so engaged is actually dealing all the time with numbers. It is through so-called practical and illustrative problems that bad teaching in arithmetic does its worst. The loss of time may be no greater; but the resulting confusion and sense of strain are apt to be more bewildering and distracting to children of the ages concerned. Every-teacher and every parent whose children have been given lessons in home arithmetic, know too well the kind of problems to which allusion is made. I am, myself, no bad mathematician, and all the reasoning powers with

which nature endowed me have long been as fully developed as they are ever likely to be; but I have, not infrequently, been puzzled, and at times foiled, by the subtle logical difficulty running through one of these problems, given to my own children. The head-master of one of our Boston high schools confessed to me that he had sometimes been unable to unravel one of these tangled skeins, in trying to help his own daughter through her evening's work. During this summer, Dr. Fairbairn, the distinguished head of one of the colleges of Oxford, England, told me that not only had he himself encountered a similar difficulty, in the case of his own children, but that, on one occasion, having as his guest one of the first mathematicians of England, the two together had been completely puzzled by one of these arithmetical conundrums.

The vice of such problems is of a double nature. First, there is the fact of undue complexity and difficulty. Secondly, there is the fact that the special faculty concerned does not normally develop in the child's mind until a later period of life than that generally concerned in these operations. In this connection I refer to the letters from President Porter and Professors Howison, James, and Stanley Hall,[1] which were made a part of my address to the Boston school board on the 12th of April last. For one, I believe it to be altogether undesirable to attempt to pry this faculty up from the mass of mind, in which, by nature's wise pro-

[1] See p. 227, *ante*.—ED.

vision, it still lies embedded and dormant, and to bring it prematurely into consciousness and exercise.

Whether one agrees with the reasons which have been presented, or not, such is the law of the schools of Boston to-day, under adequate authority; and those teachers who still believe that children should be harassed and distressed in education, for their souls' and minds' good; that the exercises of the growing boy or girl should be carried to the point of strain; and that sometimes the pupil should even be set examples he cannot perform, will perforce have to resort to some instrument of torture other than arithmetic.

COLLEGE PROBLEMS

COLLEGE ATHLETICS
1893

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COLLEGE ATHLETICS.

I TRUST it will not be deemed beneath the dignity of this occasion that I should ask your attention to a few thoughts regarding college athletics. No theme is to-day of greater consequence to the colleges and universities of our land, whether as influencing school discipline or as affecting the standard of scholarship. Alike those who applaud and those who deprecate the growth of athletics must admit the importance of the subject.

The past ten years have witnessed a remarkable development in the direction indicated, which we may well pause to consider. The rising passion for athletics has carried all before it. Thus far, at least, there is no sign of reaction or even of the exhaustion of the forward impulse. Honors in football, in baseball, and in rowing have come to be esteemed of equal value with honors in the classics, in philosophy, or in mathematics; and if the movement shall continue at the same rate it will soon be fairly a question whether the letters A. B. in the college degree stand for bachelor of arts more than for bachelor of athletics.

Among instructors and the governing bodies of our colleges there is a wide difference of sentiment on the subject. Some applaud, some doubt, some disapprove; others are simply dazed and know not what to think, or suspend all judgment waiting to see how much farther

the rising tide will encroach upon the shore. In the larger community there is, perhaps, an even more pronounced divergence of opinion. Few college presidents or professors but see some good in the new movement and sympathize largely with the enthusiasm of their pupils. But there is a host of editors, preachers, and men of affairs in the outside world, and a host of parents and guardians more directly concerned, who are sure that it is all of evil; that the colleges are simply going wild over athletic sports, preparing the way for the downfall of the traditional system of education. To many of these it is a monstrous thing that large bodies of young men should give themselves up to contests of skill and strength, and that larger bodies still should find in these contests the chief interest of their college life.

Fairly to approach the subject we need to consider the state of things which existed prior to the War of Secession; in other words, to go back just one human generation, as a human generation is usually computed. In those days gymnastics held but a small, a very small, place in American colleges; while throughout the wider community there was almost no athleticism. The two most important exceptions to the latter statement were found in the occasional outlawed and always disreputable prize fight, generally with some international complication, genuine or manufactured, for the sake of stimulating public interest, and in a small amount of rather poor, unscientific boat-racing. Almost no honor was then given to a young man because he was strong,

swift, courageous, or enduring. The college hero of those days was apt to be a young man of towering forehead, from which the hair was carefully brushed backwards and upwards to give the full effect to his remarkable phrenological developments. His cheeks were pale, his digestion pretty certain to be bad. He was self-conscious, introspective, and indulged in moods as became a child of genius. He had yearnings and aspirations, and not infrequently mistook physical lassitude for intellectuality, and the gnawings of dyspepsia for spiritual cravings. He would have gravely distrusted his mission and his calling had he found himself at any time playing ball. He went through moral crises and mental fermentations which seemed to him tremendous. From the gloomy recesses of his ill-kept and unventilated room he periodically came forth to astound his fellow students with poor imitations of Coleridge, De Quincey, and Carlyle, or of Goethe in translation.

Not all college heroes of those days were of this familiar type. Sometimes they were thunderous orators, more Websterian than Webster, who could by a single effort lift themselves to the full height of perorations which in the senate or the forum are the culmination of great arguments and of many a passionate appeal. Sometimes, though more rarely, the college hero was a delightfully wicked fellow, who did, or at least affected to do, naughty things, wrote satirical verses, was supposed to know life, and in various ways exerted a baleful fascination over his fellow students. But, however

the type of the college hero might vary, speech-making, debating, or fine writing were the be-all and the end-all of college training, as in the world outside the college speech-making, debating, or fine writing were the sole recognized signs and proofs of greatness. Physical force, dexterity, and endurance, capacity for action, nerve, and will-power went for little or nothing, so far as public admiration was concerned. Statesmanship itself was perverted by eagerness to seek occasions for oratorical display. Men of business, men of affairs, men of prudence, moderation, and real ability were crowded out of our legislative halls by shrill-voiced declaimers who could catch the ear of a nation given over to the lust of words. "Sir," once said Daniel Webster, bending those tremendous brows upon a young man afterwards renowned among the great attorney generals of the United States, "sir, the curse of this country has been its eloquent men."

What was the reason for this state of things regarding the college ideals of a generation ago, so strongly contrasted with what we see to-day? In part, bad physiology, or the absence of anything that could be called physiology, was responsible for it; but in greater part it was due, I believe, to the transcendentalism and sentimentalism of the last quarter of the eighteenth and the first quarter of the nineteenth century, which had created false and pernicious opinions concerning personal character and conduct. There was more than indifference, there was contempt for physical prowess. A

man who was known to be specially gifted in this way was thereby disparaged in public estimation. If he were known to make much of it, he was likely to be despised. It was taken for granted that he could not be good for anything else. Brains and brawn were supposed to be developed in inverse ratio. Affected notions about intellectuality and spirituality had almost complete control of the popular thought. The only things to be admired were mind and soul. "Mere bigness" was a favorite phrase of contempt. Strength was believed to be closely akin to brutality. Danger, positive danger, to spirituality, if not also to morality, lay in physical force and exuberant vitality. The same notions perverted the ideals of womanly grace and beauty. Robust vigor, a hearty appetite, and a ruddy complexion would have been deemed incompatible with the function of the heroine of a popular novel or a sentimental poem, or even with the part of a belle in society. Languor and pallor were attractive, delicacy of frame and limb was admired.

The notions referred to were doubtless closely connected with the political ideas of those days. It was an era of transcendentalism in politics. Political mechanism was disparaged. The philosophy of the age declared that a virtuous people would of themselves make a good government. On the other hand, it was impossible so to organize the public force as to give a people a government that should be better than themselves. The maxim, "A stream cannot rise higher than

its source," was a conclusive answer to all pleas for the scientific treatment of political problems. There was an affectation of indifference towards size and numbers in national life. Quality, not quantity, was in the eyes of the men of those days the sole test of the worthiness and the greatness of a people. Mass went for nothing. "Mere bigness" was here, as in the case of the individual, a term of infinite contempt. I never shall forget the rebuke, not unkindly meant or harshly spoken, which I received from a distinguished leader of public thought for boasting in a boyish vein about the extent of my country and the greatness of its resources.

The indifference toward, or the dislike of, athletics a generation or two ago was also largely due to the religious ideas and feelings of the time. The body was but a shell, a prison in which the soul was confined, and against whose bars its aspirations continually beat and bruised themselves. In another image, the body was a wayside barn in which the weary pilgrim laid himself down to rest till break of day. The flesh was an incumbrance to the spirit, a clog, a burden, a snare. Men had been told to "keep the body under," and perchance this was thought to be an easier task if that body were small and weak.

I do not mean to be understood as asserting that in those days the *mens sana in corpore sano* was never spoken of, or that there was no formal teaching of the duty of preserving bodily health. Such precepts, however, could have little effect against general tendencies

of thought and feeling; and even among the most intelligent teachers of those days there was manifest a strong dislike, a sharp shrinking from all dwelling upon the physical basis of life, as savoring of materialism. As to acknowledging the relationship of man to the other orders of animals, that would have filled the pious mind with horror. The philosophy of the time had, indeed, to admit that the soul was in a degree conditioned as to its manifestations, and especially as to its influence upon others, by purely physical causes. But the soul itself was a thing transcendent, supernal, and self-sufficing, which when released from the clogs of flesh became at once as perfect, pure, free, and strong as if its tenement, while in residence here, had been more worthy of it.

All the notions referred to, so prevalent and so potent in at least this section of the United States forty or seventy years ago, have gone, and gone together. Other ideas better suited to inspire a progressive civilization have taken their place. In part this has been due to the decay of superstitions derived from primitive savagery, in part to the effects of positive teaching, in greater part still to further experience of life. Biology has done its share; political education has done its share; the war of secession wrought its appointed work in the same direction. The men of to-day are generally agreed that they are likely to live long enough to make it wise to think a hundred times how they shall live, to once thinking how they shall die. The caravansary idea of existence has been abandoned. Man is not a pilgrim,

but a citizen. He is going to tarry nights enough to make it worth while to patch up the tenement and even to look into the drainage. This world is a place to work in; activity and development, not suffering or self-repression, its law.

The present generation has witnessed a wonderful diminution of spiritual self-consciousness. Better physiology, coinciding with some changes in popular ideals, has driven away the notions about the flesh as an incumbrance, a clog, a burden, a snare. It is seen that morbid or even merely feeble conditions of body tend to generate delusions, selfishness, and susceptibility to the worst impulses. This is seen to be the case not the less because of the saintliness and the heroic constancy of a million sufferers from pain and infirmity. Hearty physical force may, indeed, consist with vicious desires, but it does not favor them. On the contrary, it does in a way and in a degree tend to diminish and to uproot them. Vicious desires are at their worst in feebleness and in morbid conditions of body. The sounder a man is, the stronger he is, the less—other things equal—is he subject to what is bad and degrading; the more pleasure does he take in what is natural, healthful, and elevating. To a man perfectly sane physically life itself becomes a joy. The relish for it does not need to be stimulated by the spices of vicious indulgence any more than a healthy appetite needs to be stimulated by the spices of the cuisine.

The sociological investigations into the causes and

manifestations of crime, so actively in progress during the past few years, have added much to our knowledge of human nature in its self-respecting and law-abiding phases. The popular idea of the criminal once was that of a powerful brute, whose offenses against society resulted from an excess of physical vigor not counterbalanced by moral and intellectual forces. It is now known that, as a matter of fact, the prisoners in our jails are, as a class, undersized and undervitalized creatures, often with a deficiency of co-ordination between their faculties, sometimes with a minimum of control over their own actions and little adaptability to social and industrial functions. In the remarkable, the truly admirable reformatory enterprise of Superintendent Brockway at Elmira, gymnastics, regulated exercise, and manual training perform a most important part.

In the revolution of thought regarding bodily development and physical prowess Mr. Beecher exerted a great influence. He it was who led off in favor of Muscular Christianity. During the controversy on that subject which attracted so much attention just before the outbreak of our great war there was, we must admit, not a little exaggeration on the part of the advocates of physical culture. Many wrote and spoke as if all evil were to be worked off in the gymnasium and on the race track; as if every vice of human nature would exude through the pores of the skin were perspiration only sufficiently active and long enough maintained. But in spite of much that was crude and foolish, these men

had hold of a great truth, and they did not let go until they had drawn it out into the light. The War of Secession, also, which has been adverted to, came in to produce a vast change in popular sentiments and ideals, as it showed how much nobler are strength of will, firmness of purpose, resolution to endure, and capacity for action than are the qualities of the speech-maker and the fine writer, which the nation had once agreed chiefly to admire.

With this change of opinion regarding physical force and physical training in the individual has come a notable change in the political philosophy of the age. Larger experience of affairs has shown the folly of disregarding political mechanism. It is seen that it is hard enough to keep the balance of forces upon the right side, if every safeguard be adopted, every device used, and every means employed to give a preference to those who stand for order, decency, and honesty in the community. We are all now for making the devil fight with the sun in his eyes, instead of at his back, and with the advantage of the ground against him, instead of in his favor. We no longer with confidence hold that a virtuous people will necessarily have a good government. On the contrary, we recognize that a people virtuous above the average may be made, through a bad organization of the public forces, to act almost as if they were the most cowardly and dishonest of their kind, as did our forefathers under the confederation of 1781–87. It is true that the stream may not of itself rise higher than its

source, but by machinery we can send a stream a good deal higher than its source, and can make it do there more of vitally essential work than could all the waters of old ocean lying at their level. Instead of discarding political mechanism, therefore, the men of to-day believe in political machinery, like that of the Australian ballot system. They have learned that by means of it they can help the cause of righteousness, and at times turn the scale against the forces of evil. They not only believe in political machinery, they even believe in political machines, actual structures of wood and glass like the patent ballot-box, as important agencies to defeat the baser elements of society.

Again, "mere bigness" has ceased to be a term of contempt as applied to nations. Power in a people has become a thing admired. It is felt that it is indeed a glorious thing to have a giant's strength; nor is it longer believed that the disposition to use strength tyrannously grows with the opportunity. The idea once prevalent that its possession leads to brutality and insolence has not been borne out by the history of our own people. As the United States have grown more powerful they have grown more peaceful. In the early days of the republic our petulance, irritability, and pugnacity made us a nuisance and a pest among the nations. Swagger and unbounded brag characterized our earlier diplomatic history; while the war with Mexico, the cheap talk about "manifest destiny," and the filibustering excursions of the middle of the century seemed to point us out as a

bad neighbor to the strong and a bully towards the weak.

Doubtless the slave power was in some degree accountable for this; but in greater measure it was due to lack of confidence in ourselves. We were always afraid that we were not going to be respected and treated with due consideration. We felt that we were looked down upon because we were young and small. No sooner was the mighty demonstration made of our courage and military strength in that great Civil War which will always remain one of the marvels of human history, than all this fell away from the nation like some loathsome rheum of childhood. To-day Canada and Mexico repose under the shadow of our irresistible power without an apprehension of harm or wrong, and it is even difficult to secure from an over-lavish Congress appropriations sufficient to enable us to make a decent show of naval power in the great harbors of the world. It is true we have recently suffered an apparent brief access of jingoism, owing to certain unfortunate political complications; but the readiness with which the affair with Chile was adjusted and the general applause with which our flag was hauled down from the government house at Hawaii showed how superficial and how partial was the infection.

After this long and tedious statement of changes in the ideas and sentiments of our people in the several directions indicated, is it too much to say that, as a community, we have got down upon a sound, practical, sen-

sible, worldly basis of life, much more promising for morality, for a steadily progressive civilization, for enduring enthusiasms—aye, for worthy aspirations and a true spirituality—than the unreal, morbid transcendentalism and sentimentalism of three, two, or even only one generation ago?

Among the many things, good or bad as people may esteem them, resulting from the changes in feelings, views, and ideals which have been indicated, are two which especially concern colleges and college men: The first is the general disappearance, most fortunate as I esteem it, of the literary societies formerly so flourishing, and the decay of oratory, declamation, and debate, which to many once made up the main interest of college life. The second is the rapid growth of athletics, in which immense honor is given to young men because they are strong, swift, enduring, and brave; in which the blood of the whole community is stirred by physical contests among the picked youth of the land as once it was stirred only by tales of battle. This last it is which has given me my subject to-day.

That the general introduction of gymnastics into colleges is desirable, few will deny. Young men of the college age whose occupations are largely sedentary should be encouraged to undertake systematic and extended exercise in order to correct the faults of the study and recitation-room, to expand their frames, and to promote an active circulation. Amherst is entitled to the high honor of being the first of the American colleges

to make ample and suitable provision for students' needs in this respect. In 1861, under the presidency of Dr. Stearns, a gymnasium, large and well equipped according to the standard of those days, was placed upon the campus; daily exercise was made compulsory upon students not excused for cause, and a certificated physician was made director of physical culture and lecturer on physiology and hygiene. Few colleges have followed Amherst in making exercise other than in the form of military drill compulsory;[1] but fewer still now fail to afford their pupils opportunity for voluntary gymnastics to the top of their bent. The improvement thus wrought in the physique of our college students does not need to be shown statistically; it is manifest to the eye of the most casual observer who remembers the former state of things. So far, there is no ground of debate;

[1] There is no such source of *in*discipline as pretended military drill and training when the requirements are not promptly, severely, and unflinchingly enforced. There is no better training for mind and body than military drill well and intelligently carried on. All modern drill associates with itself "setting-up" exercises and regulated gymnastics. The modern soldier must be an athlete.

I think there is nothing which the young men of this country need more than to be taught to obey, to "mind," as the boys say; and to do it without any nonsense, or "back talk," or delay. For lack of this we are raising up a large class of boys who, in mind and character, are perfect "punk," without fiber and without grain.

I do not say that military training and drill in high schools, even under the best officers, would remedy all this,—in most cases the evil is done before the boy reaches that point,—but I have no doubt that the effects would be beneficial. I am not in favor, however, of small or feeble boys carrying muskets.—*Answer to the question: "Do you believe that military drills are consistent with pedagogy?" asked in a circular letter from the editors of "Mind and Body,"* 1896.

difference of opinion exists only with respect to the competitive sports and games which have grown out of the newly awakened interest in physical prowess.

And here let me propose a distinction between gymnastics and athletics, which will be carried through the remainder of this discussion. That distinction is not one based upon etymology, but has reference to current usage:

Gymnastics are for individual training and development, with health strongly in view. Athletics take the form of competition and contest; emulation is their moving spirit, glory their aim.

As thus distinguished in their primary objects, athletics differ from gymnastics in two respects: First, by specialization, as when a man chooses his line of work in athletics—whether that be pole-vaulting, or hurdle-racing, or rowing, or pitching in baseball, or playing a certain position in football—and thereafter devotes his energies to working himself up to the highest point of efficiency in that line; secondly, by excess in the amount of exercise over what would be required or would be performed without the introduction of the spirit of emulation. So great is this excess that it may not unfairly be said that athletics begin where gymnastics leave off.

The effects of specialization in athletics are too much a matter of detail to be entered upon here. Suffice it, in a word, to say that they are not unlike those of specialization in industry—good and evil being mingled, with, in general, the preponderance largely on the side of the

good. Specialization affords to bodily exercise a more direct object and creates a far more intense and sustained interest. Moreover, for the best specialized work it is well known that at least a fair all-around development is almost always a necessary condition.

The excess of exercise in athletics over gymnastics, as we have defined these terms, is it of good or of evil? Is it a gain, or mere waste, or a positive injury? Gymnastics are a means to the end of health and vigor. Athletics become an end in themselves. With exceptions too inconsiderable to be enumerated, the athlete competing for championship honors takes more exercise, often far more exercise, than is required for health and strength with a view to the peaceful and industrial pursuits of life. Vital force is consumed, not created, by the final contests in which he engages, and not infrequently by the training to which he subjects himself in preparation for them. The consumption of vital force in athletics, if we contemplate young men who are fully grown or nearly so, may be considered as of two degrees: First, where vital force is consumed in competitive sports and games as it might be consumed in study or in the production of wealth, without impairing the constitution or diminishing the physical endowment upon the strength of which the subsequent work of life is to be done; secondly, where exercise is carried so far and such violent exertions are made that not merely is the current supply of vigor used up in this way, but the constitution is undermined and injuries are sustained or exhaustion

induced which result in leaving the man less healthy or less powerful through the remaining years of his life.

Of the severer forms of athletic competition and contest, which injuriously affect the constitution and permanently impair the vital force, but one thing can be said: they are evil and only evil. No earthly object, except the saving of others' lives or the defense of one's country, could justify such destructive exercises and exertions. I am disposed, however, to believe that there has been much exaggeration in the public mind regarding this matter, and that instances of permanent injury from athletics are fewer than popular rumor or maternal anxiety makes them to be. The life history of the leading football players of the past fifteen years, notwithstanding the frequency with which contusions, sprains, and even broken bones occur in the tremendous struggles of that mighty game, makes up a record of vitality and activity in the period succeeding graduation which proves that, despite the occasional outcries of the press, this form of athletic contest works little enduring injury among thoroughly trained competitors. The more serious accidents of football generally occur in the beginning of the season and among players who have not passed carefully through the hardening stages of practice. Boat-racing is probably fraught with much more real peril to its participants; yet a distinguished English statistician, studying the life history of three hundred and twenty "Oxford oars," has reached the conclusion that, even after making due allowance for the fact that

these were all at the start picked men, this great body of athletes showed a vitality distinctly above the average. Yet, when all has been said, it is still beyond question true that in the present intense interest in physical contests there is a real danger to be guarded against, especially among the younger and less experienced competitors.

Of those physical contests which result merely in the consumption at the time of current physical force which would otherwise, or might otherwise, be devoted to study, we cannot dispose so confidently and summarily. To those who hold to the good old notion—the excellent, virtuous notion—that all young men go to college to make themselves scholars, it is, indeed, a great trial to have to contemplate a state of things in which no inconsiderable proportion of students treat scholarship as an object distinctly subordinate to gladiatorial prowess, and who are graduated really, if they are graduated at all, in athletics as a major, with classics, or mathematics, or philosophy, or something else as a minor,—or perhaps we should say, a minimum. Certainly this presents a view of college life which would have filled with horror the founders and early governors of our New England colleges. And it needs to be said at the outset, in dealing with this subject, that there are hosts of young men coming to college whose circumstances and means and views and plans of life are such that they cannot afford to treat their educational privileges in this way; who if they "go into athletics," in the accepted sense of that

phrase, will sacrifice the one opportunity offered them; whose presence with their classes means a degree of sacrifice and self-denial on the part of parents and friends which would make it little less than profanation to waste an hour of the time purchased at such a price. And yet, with due consideration for the rights and interests of students like these, college athletics confessedly as an end in themselves are not wholly evil. Several things have to be considered before we are fairly in a position to pass judgment upon them.

The least important thing that can be said in their favor is that they afford enjoyment to vast numbers throughout the land; yet, for one, I would not treat even this consideration as unworthy of respect. The college athletics of to-day do wonderfully light up the life of our people. The great recurring contests and the intermediate practice games and friendly competitions of the several teams give acute delight to a large and increasing constituency. This nation has long shown the painful need of more in the way of popular amusement, of more that shall call men in great throngs out into the open air, of more that shall arouse an interest in something besides money-getting or professional preferment. In these respects college athletics have made an important contribution within the past few years. The marvelous rapidity with which football has spread and is still spreading throughout the Western and Southern States shows how eagerly it is welcomed as a relief to the monotony of life.

A stronger plea for college athletics is made when it is urged that they result in stimulating an interest in gymnastics not only among those students who do not engage in competitive contests, but also throughout the general community. The effect of this may easily be exaggerated. There is many a weak-kneed collegian who crawls out to witness the great baseball or football game of the year, looks on with intense delight, cheers the victors, if of his own side, as loudly as his limited lung capacity will permit, and then, when all is over, crawls back again to his room without so much as a conscious impulse to improve his own bodily condition. Yet it is certain that the cause indicated has an influence, and an influence not inconsiderable, for good. Admiration for manly prowess and the contemplation of fine physical development cannot fail to secure a much wider cultivation of gymnastics than would take place without it.

But, again, it must be said that the favorite athletics of to-day are, in great measure, such as call for more than mere strength and swiftness. They demand, also, steadiness of nerve, quickness of apprehension, coolness, resourcefulness, self-knowledge, self-reliance. Further still, they often demand of the contestants the ability to work with others, power of combination, readiness to subordinate individual impulses, selfish desires, and even personal credit to a common end. These are all qualities useful in any profession; in some professions they are of the highest value; and it cannot be gainsaid that it is the normal effect of certain kinds of athletic sports

to develop these qualities among the contestants, as well as to afford impressive examples to the minds of the spectators. So genuine does this advantage appear to me that were I superintendent of the academy at West Point I would encourage the game of football among the cadets as a military exercise of no mean importance. It is the opinion of most educated Englishmen that the cultivation of this sport in the public schools of that country has had not a little to do with the courage, address, and energy with which the graduates of Rugby, Eton, and Harrow have made their way through dangers and over difficulties in all quarters of the globe.

The last consideration which I would adduce to show that what is sacrificed in athletics is not all lost is that in the competitive contests of our colleges something akin to patriotism and public spirit is developed, with results, on the whole, of good. It is true that young men often carry their manifestations of zeal and devotion to their colleges too far. Yet, both as counteracting the selfish, individualistic tendencies of the age and as an antidote to the *nil admirari* affectations of our older colleges, it is a good thing that the body of students should now and then be stirred to the very depths of their souls; that they should have something outside themselves to care for; that they should learn to love passionately, even if a little animosity towards rivals must mingle with their patriotic fervor; that they should at times palpitate with hope and fear and anxiety in the view of objects which can bring to them personally neither gain nor loss.

Of the special evils of college athletics as now cultivated I do not purpose to speak at length. Some of those at present most clearly perceived are chiefly due to newness and rawness, and will of themselves disappear, in whole or in part, with time and further experience. Faults of method have yet to be eliminated; the traditions of the several games have yet to be created. For example, that regard for fair play, that respect for the rights of an opponent, that deference to the decisions of the umpire, so conspicuous in England, have there been the work of generations. They cannot be built up in a day with us. Yet our people are wonderfully quick to learn, especially to learn everything that conduces to harmony and adjustment of claims; the American is eminently and pre-eminently a political animal; and nowhere in the world are great crowds so orderly, peaceable, and good-natured as here.

One of the first things which should receive the attention of all lovers of fair play is the complete abolition, once and for all, of the unsportsmanlike system of organized cheering by great bodies of collegians grouped together for the purpose, with chosen youths of peculiar gesticulatory graces and extraordinary lung power to start the movement and "deacon off" the shouting. Such a line of conduct, thoughtlessly resorted to in the heat of partisanship, is unworthy of educated men. It is unfair to the visiting team, who by all the laws of courtesy are entitled to special consideration. How much more pleasing to the spectator, how much more

creditable to the home college, if the stranger for the while within its gates were to be treated with something like the grace of antique chivalry!

Again, we may confidently expect that the machinery for carrying on sports and contests will undergo a steady improvement. We see a remarkable instance of the virtue of this in the appointment of the second umpire at football, which at once did away with certain tendencies that had threatened to make the game impossible. Audiences, too, must be trained to appreciate the finer points, to applaud good work by whomsoever done, and to be as virtuous as a Greek chorus, to the end that the game may be played by the players and not by the spectators. The co-operation of alumni is also to be invoked to give wisdom, weight, and temper to the action of the undergraduate bodies. Not least,—nay, perhaps hardest of all,—Faculties are to be educated, to avoid intermeddling and petty dictation on the one hand, and to sustain the claims of scholarship and enforce the right discipline of college on the other.

The last clause suggests one of the most important considerations related to the subject. Granting that something, and that not a little, of scholarship must be sacrificed if athletics are to be continued on anything approaching their present scale, may we yet believe that it is practicable to insist upon the requirement of at least respectable standing in the case of all who participate in intercollegiate contests? I believe that this can be done without interfering with the general movement,

provided college Faculties are true to themselves, fair, frank, and firm in dealing with the student bodies, and thoroughly honest in their treatment of the subject. I would not be understood to intimate that a certain amount of good sense would be out of place.

Perhaps it will not be taken amiss if I allude here to the results of my own observation in a sister university regarding which it has been my lot to know more than I do concerning Harvard. At Yale, and especially in the scientific department, the Faculty appear to me to have been highly successful in preventing a total sacrifice of scholarly standing to intercollegiate sports. But a small proportion of the champion athletes in that university, a smaller proportion still in the scientific school, have been men at or near the foot of their classes—the sort of men who have to be hounded, threatened, and repeatedly conditioned in order to keep them up to the mark. Not a few of them, from Kennedy to Hartwell, have been high up on the roll of academic honor. I attribute this excellent result to the thoroughly good understanding between students and the Faculty, to the absence of petty prescriptions and of all intermeddling as to details, and to the frankness with which the few positive requirements relating to the subject are stated and enforced.

I fear there is little in what has been here said to give comfort to those who distrust and dislike college athletics—little which intimates the opinion that the athleticism of to-day is only a reaction after the former

total neglect of gymnastics, or a mere passing passion among our youth. But if we concede that these exercises and contests are to hold their place in American life, is there no stopping-place, no point at which college authorities or the young men themselves, on their own motion, in their own discretion, for their own good, can say, "Thus far and no farther"?

I answer, yes; there is such a natural stopping-place. It is at the doors of the professional school. Among young men in the course of education, athletics should belong to the college stage; gymnastics to all stages. Whether this shall be done by regulation, or be left to the operation of forces working upon the minds of the individuals concerned, I believe the result indicated will, in either case, be reached. Already the undergraduate principle is widely though irregularly recognized; and the movement of opinion is still clearly in progress in this direction. Here at Harvard you have seen many a renowned champion put off athletics as he entered the law school or the medical school. The rule should be made of universal application; and it will require but a little more discussion, a little higher education of student-opinion, to bring this about. In and after the professional school, whether that be a school of law, of medicine, of divinity, or of technology, there should be no representative teams. The principle of competition and championship should be dropped. Individuals should continue, at their pleasure, to play tennis or cricket or football with their classes, with pri-

vate clubs, or in town and county matches; or if teams be formed in such schools they should not be regarded as carrying the honor of their institutions around with them. Such teams should not expect victory. They should play for exercise and for the fun of the thing, and should accept their inevitable beating with serenity and good nature, recognizing the fact that since they have taken up the serious work of professional preparation for life they no longer have the time or the strength at command to make and to keep them champions.

There is one remaining question regarding the athleticism of to-day, which I feel myself so little qualified to discuss that I did not even allude to it while enumerating the things that might be said in favor of competitive sports, or at least in deprecation of the hostile criticisms directed upon them, but which in closing I would propose to your sounder judgment and keener thought.

It is whether the college athletics, which so many approve and so many condemn, have not after all a deeper significance—whether this remarkable outburst of enthusiasm for physical development and for the perfecting of the human body is not related, perhaps vitally and intimately, to the growth of a feeling for art in this new land of ours. No classical scholar will for a moment admit it to have been an accidental coincidence that the nation of the Old World which pursued athletics with the most passionate eagerness, which showered honors upon the victor in running or in wrestling not inferior to those which it gave to the author of an

accepted tragedy—that nation whose tribes came by long and perilous journeys over stormy seas to witness the great athletic competitions by the banks of the Alpheus or on the Crissæan plain—was the same nation which carried the arts, and especially the plastic arts, to the highest point of perfection ever attained.

If, indeed, there is believed to have been a vital connection between these seemingly diverse manifestations of Grecian life, who shall say that the remarkable enthusiasm for physical training and the intense interest in athletic contests which have been so suddenly developed in our country may not be clearly seen a generation hence to have accompanied, and that through no accidental association, the elevation of art to a far higher and nobler place than it had before occupied in the thoughts and affections of our people? The life-class is the true school of the artist. The greatest of all who bear that name have been men who revered the human form, made it their chief study, and found in it their highest delight. If in truth this sublime passion is taking possession of the nation, who shall estimate at a price the worth of that inspiration? The vision of the Apollo may yet rise to the view of thousands out and up from the arena at Springfield, as erst it rose before the thronging multitudes of Olympia.

THE STUDY OF STATISTICS IN COLLEGES AND TECHNICAL SCHOOLS

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THE STUDY OF STATISTICS IN COLLEGES AND TECHNICAL SCHOOLS.

During the past twenty or even ten years there has been an astonishingly rapid development of historical and economic studies in our higher institutions of learning. At the recent meeting of the American Historical Association, in Washington, President Adams of Cornell presented an account of the work at present done in history in our leading colleges. To one who was graduated thirty years ago, this account reads strangely enough. In place of, at the most, a single brief series of lectures on the so-called philosophy of history, we now find course after course of advanced historical study, with the free use of the library and with the most improved methods of the German *Seminar*, offered to students as a leading feature of their undergraduate work. Several of our American colleges have developed these courses in such variety, to such an extent, and with such a wealth of material, that they might not unfairly be called schools of history; and every year sees this carried further and further, with continually better and better results.

In the kindred department of economics, the progress made in recent times has been second only to that which we have noted regarding history. Indeed, the progress in the case of economics has been less only in respect to

the number of colleges which have undertaken extended courses. In the institutions where both the new departments of study and research have been given scope, the extent to which political economy has shared in the growth of the past few years can scarcely be said to be inferior to that obtained by history. Neither in the ability and reputation of the instructing staff, nor in the number and variety of courses offered, nor in the attendance and enthusiasm of the classes formed, does political economy yield to history, at Harvard, or Yale, or Columbia, or Cornell. Together these two closely related departments make up a very large and constantly increasing part of the modern university.

Unfortunately, while this rapid development of historical and economic work has been going on, a branch of study which has the highest virtue at once to train the hand of the historical or the economic scholar and to furnish him with professional tools of the first importance has been almost wholly neglected. I refer to statistics, whose very methods are hardly known to the great majority of our economists and historians; and which is still to have its first chair founded in an American college. There are, indeed, a few schools where a little elementary instruction has, of recent years, been given in the use of figures as a means of testing sociological conclusions; but in no one of them has a full, proper course of statistics been established. It cannot be long, however, before the growing interest in economics and history will compel the recognition of

statistics as a distinct and an important part of the curriculum of every progressive institution. The main difficulty will be to find the men who have had the training, at once severe and liberal, which will qualify them to inspire and direct these studies.

The three uses of statistical study, aside from its value as a means of discipline, are, in their order from lowest to highest, as follows:

First, to enable the student to detect the fallacies in conclusions drawn by others from quantitative statements concerning human affairs, actions, interests, in which adventitious elements lie concealed, or from which something essential, or at least relevant, has, by inadvertence or dishonest design, been excluded.

Secondly, to enable the writer or the speaker upon politics, economics, history, or sociology safely and effectively to illustrate and emphasize his conclusions drawn from a study, itself perhaps mainly or wholly non-statistical, of the subject to which he devotes himself.

Thirdly, statistics may, under proper direction and with due safeguards, be used for the discovery of social laws.

The first of these objects could perhaps only be fully attained through those long and weary stages of training which would be required to qualify one for the highest exercise of the statistical faculty, as last stated; but a very large part, at least, of the result desired, can be reached by a little very elementary instruction. To take an illustration from another department of study,

we may suppose that an adequate course in logic, sufficient to make a man, otherwise well trained, a sound and accomplished reasoner, might be compassed in a certain number of exercises per week, continued through two academic years. Yet, if time be not afforded for such a course, a great deal might be done to enable the student to detect false conclusions on the part of others, and to save him from the grosser errors of reasoning in his own writing or speaking, by means of a dozen hours devoted to fallacies. In much the same way, if a full course in statistics cannot be given, a few exercises upon the abuses of statistics may serve at least to keep one from a certain class of blunders from which men of the greatest acuteness and learning might not otherwise be exempt.

Let us take an illustration of the sort of errors against which the merest elementary study of statistics might prove a sufficient protection. A meritorious writer adduces as a proof of the great fall of prices which took place in New England between 1630 and 1640, that a cow which, at the former date, was worth £25 to £30, would have brought, at the latter date, but £5 to £6. Now the bare facts here are not in dispute; nor is it to be questioned that a fall, a great fall, in prices did take place in New England during the period referred to. Yet the statement quoted contains a gigantic blunder,— a blunder which a student of statistics would probably be incapable of making. In 1630, the value of a cow in New England represented the immense cost and risk

of bringing an animal, by a slow-sailing vessel, thousands of miles, through comparatively strange seas, into a foreign climate. Ten years later, the value of a cow represented only the cost and risk of rearing her upon the soil. The cow of 1630 might still be living, surrounded by ten, twenty, or fifty of her descendants, born in New England.

Errors of this type are countless. They occur in the writings, they are heard in the speeches, of men learned and otherwise acute, but who have never been trained to detect the fallacies that lurk so cunningly under all groups of figures. Volumes might be filled with instances of statistical blunders of a class which a very elementary course would forever render impossible to any careful writer or speaker. Such a course would embrace a host of illustrations, affording examples of the kinds of error which especially beset the use of figures for sociological purposes, and would direct the attention of the student to the best means of exercising care and pains in escaping them.

It is easy to say that, if statistics be in truth such "kittle cattle," if danger lurks thus under every group of figures relating to social and economic matters, it would be better to eschew statistics entirely. But mankind will not consent to give up an agent of such power because of the abuses to which it is subject. If all men at once honest and candid were to forbear to employ statistics in such discussions, lest peradventure they should lead some astray, we may be sure that all the dis-

honest and uncandid would resort to their tables and diagrams with redoubled zeal. There are few instincts more strong than that which urges men to give a quantitative expression to the results of human experience. Men will do it, or have it done for them by others. No warning as to the possible errors of such evidence can prevent this appeal, or diminish the eagerness with which it will be made. What we must needs do, if we will promote the truth, is to instruct and exercise the citizen, as far as we may, in the scrutinizing, sifting, and testing of alleged statistical proofs.

What has just now been said brings me to the second of the objects enumerated as to be sought through the study of statistics: namely, to qualify and prepare the future writer or speaker upon political and economic and social questions safely and effectively to illustrate his conclusions, derived perhaps through processes mainly or wholly non-statistical. I have said that the instinct which leads men to seek quantitative statements for the results of human experience is one of the strongest in our nature; and that people will have this done, whether it is to be done rightly or wrongly. He then, who, in addition to the merits of sound and just thinking on social subjects, possesses the power of aptly using statistics, acquires thereby a great advantage, whether in exposition or in controversy, over almost anyone, however gifted or brilliant in argument or in the graces of speech, who has not this peculiar faculty. All who have widely observed audiences gathered for the purposes of

political discussion must have seen the almost ludicrous liking which they have for statistical statements. The crudest thinking is oftentimes carried through by an array of worthless statistics, which would not bear a moment of cool, critical investigation. Quantitative statements that are scarcely even relevant to the subject are, for popular purposes, better than none. What power, then, can a real master of statistics wield over his hearers! Attend a meeting where Mr. David Wells is speaking, and see how he holds the crowded audience in close attention for two hours, with no help from rhetoric, elocution, or gesticulation, merely by the strong, vivid, effective way in which he marshals figures. There are few orators who can so completely command the thoughts of their hearers, for the same length of time, by all the graces of speech, or even by stately and beautiful thoughts, as this publicist, whose style of speaking is not merely unfinished, but positively bad. Mr. Cobden owed very much of his extraordinary power to the same cause. Mr. Gladstone is an even more remarkable example of the virtue of this art. Unthinking people say that he must be a wonderful orator, because, in spite of the serried masses of figures which belong to a budget speech, he has more than once held the House of Commons strictly silent and attentive for the space of three or four hours. The fact is that that remarkable success was not obtained in spite of statistics, but by reason of them. There is no spectacle on which men, whether more or less educated, look with more breathless interest

than the marshaling of a vast array of figures which move and take their allotted place, in natural succession and in due order, at the bidding of a real master of that art.

Since so much popular interest attaches to the use of statistics in addressing any large audience, whether from the platform or from the author's or editor's desk, it is clearly worth while for every person who is under training to become a writer or a public speaker to undertake all the instruction and practice which may be necessary to enable him to put together at least clearly and correctly the facts and figures which relate to any chosen subject. We cannot all be Cobdens, Gladstones, or Wellses; but every educated man can learn to construct tables and diagrams which will bear the test of a fair scrutiny and liberal criticism. To do aught in the way of statistics at which fools will not peck is, of course, beyond any man's power.

Those who have never tried their hand at statistical work will fail to appreciate the difficulties to be encountered at the start and the frequently recurring need of going back and beginning all over again. To go to a series of extended tables with multitudinous subdivisions, in which a given total is distributed among many classes, and to take therefrom just what you want, no more, no less, and no other,—to make sure that your parts when put together will form a whole, and that no direction conveyed by the heading of a single column has been neglected,—is a task for which men must be

trained, and in which they must be practiced, going from simple and easy examples to complex and difficult ones, by patient steps. The great majority of editors and writers for the press, the great majority of legislators and public speakers, either fail in such work, or, more likely, judiciously avoid the attempt, even though statistical matter altogether relevant to the subject, and which might be made most interesting to their readers or hearers, lies on every side of them. In my long experience in office at Washington, nothing struck me more forcibly than the helplessness of Congressmen—even, with few exceptions, the acutest and best trained—to prepare the figures for their own speeches. No matter how clear their conception of the positions they wished to present, few of them could readily and confidently resort to the government publications at hand for the statistical materials with which to illustrate and enforce their views; and the gratitude with which they would accept and acknowledge some trifling assistance from a well-trained clerk was almost ludicrous. I do not intend any disparagement by this statement. Statistics have a language of their own, and he who would use them must first learn that language; and this is as yet taught scarcely anywhere.

A striking example of the liability to mistakes which constantly besets the compilation of statistical tables was afforded in a book published, some years ago, under the title, "The Statistics of the United States." The plan of the work was a good one; such a book was needed; but

the author evidently had not had the training requisite safely to carry out his scheme without falling into the gravest errors. For instance, the work undertook to present the expenditures of the United States for each year since the formation of the government. The figures used were taken directly from the finance reports of the Treasury Department, and were hence of the highest official authority. Unfortunately, however, the compiler went for this purpose to the column of "Gross Expenditures," and transferred the figures he found there into his table. The result was that for some years he was out of the way by several hundreds of millions of dollars, since during these years the Treasury issued large loans to pay off other loans contracted during the war at high rates of interest. Thus, for 1868 this writer gave the expenditures of the government as $1,093,079,655,—a very expensive government indeed for a time of profound peace! The facts were as follows: The "net ordinary expenditures" of the government that year were $202,947,734; there was paid from the Treasury, in bond premiums, $10,813,349; and, as interest on the national debt, $143,781,592; making the total expenditures of the government on these accounts, $357,542,675. In addition, the Treasury redeemed bonds to the amount of $735,536,980; and this, mainly, out of the proceeds of fresh loans, at lower rates of interest. All this vast sum, more than twice the actual expenditures of the government, even after including bond premiums and the current interest on the public

debt, was embraced in the financial statement of the last year of Mr. Johnson's administration. This mistake was committed in connection with each successive administration, from Washington's down.

It is needless to say that blunders of such a magnitude completely destroyed the prestige of the book, and that, although it was intended to be issued from time to time, with the facts and figures brought down to date, it was never heard of again.

Another example of statistics rendered actually delusive by the neglect of elementary considerations is found in a recent work on State and Municipal Taxation, a book which, in many of its views and suggestions, makes a valuable contribution to economic literature, but is, statistically, very faulty. Thus, in a "comparative table" showing the "principal receipts, total receipts, and total expenditures" of certain leading cities, New York is put down for $73,309,884 of total receipts, in 1886, and for $71,750,743 of total expenditures. Now the fact is, that nearly twenty millions alike of the receipts and of the expenditures represent nothing but temporary loans, contracted and paid during the year. City taxes come in mainly during a brief period. In order to prevent the necessity of keeping a vast sum of money in the treasury for months together, the government properly borrows in the "dry season," and liquidates its obligations when the taxes set in like a flood. Yet, in the work referred to, this fact was allowed to swell the expenditures of the city more than one-third.

Had the city treasurer found it expedient to borrow ten millions more for one, two, or three months, this would have carried the "expenditures" of New York up to eighty-one millions!

Instruction directly intended to qualify a student to use statistics, and to compile tables with ease, confidence, and accuracy, is now given at Harvard University, Columbia College, the Institute of Technology, and probably elsewhere. The pupil is taught to look up the data relating to a given subject, as these may be found scattered through long series of official reports; to bring the various statements together; to examine them as to their proper comparability; to test their accuracy by all means which may be available; and to put them together into tables. The student is further taught to work out the percentages involved and to set one class of facts into relation with others; as, for example, to compute the ratio of valuation, or of expenditure, or of mortality, to each million or each thousand of the population concerned; and, finally, to make diagrams or charts, which shall exhibit graphically the several elements, taken in their due proportions, as ascertained by the investigation. In none of the higher institutions, however, is this branch of study carried as far as it ought to be; nor are all the methods of instruction in this department yet worked out to their greatest efficiency. Still, the good work has been well begun; and the constantly growing appreciation of the ability to compile and to use statistics for the purposes of political, economic, and social dis-

cussion cannot fail to cause a rapid development of this feature of the college course. The American Statistical Association, under the able secretaryship of Professor Davis R. Dewey, is doing much to promote this study; and it is the desire of its officers that its Journal may become to a considerable extent at once the organ of communication, of suggestion, and of friendly criticism among the working statisticians of the country, and the repository of the best essays in this line from our leading colleges and universities; affording, in the latter way, a great impulse to the study of statistics in connection with the academic pursuit of history and economics.

The scope of this paper does not include a discussion of the subjects and the order of studies designed to give the investigator the power to discover statistically the laws which govern the action of social and economic forces. Such a course would necessarily be long and severe. For the best results it should embrace the highest mathematics of our American colleges, and should be largely directed to the development of the biological sense. The number of those who, otherwise than as a means of mental training, would have occasion to undertake such a course, would necessarily be small. There is reason to wish that all citizens, from the highest to the lowest, might undergo so much of training in statistics as would enable them to detect the errors lurking in quantitative statements regarding social and economic matters which may be addressed to them as voters or as critics of public policies. Comparatively few of these,

however, would ever have occasion to prepare such statements for themselves, and would thus have use for the special faculty which is required for the compilation of statistical tables and diagrams. Far smaller still will be the numbers of those whose natural endowments and whose chosen pursuits would justify the long and laborious training, the patient practice, and the acquisition of the large and various learning, which alone can qualify the student of history, of sociology, or of political economy confidently and surely to educe from thousands of pages closely packed with figures some hitherto unsuspected law of human life or conduct.

NORMAL TRAINING IN WOMEN'S COLLEGES

1892

From the *Educational Review*, November, 1892.

NORMAL TRAINING IN WOMEN'S COLLEGES.

It is now a little more than twenty-five years since a college for women was founded in the United States.[1] From the first the new enterprise attained a high degree of success, whether as measured by popular appreciation or as tested by the strictest scrutiny of its results; and in the face of the fast-increasing demands of the older colleges, and in spite of skepticism and incredulity, the educational system of the United States has been rapidly and strongly developed along the line thus taken. Without considering the coeducational institutions at the West and South, we already have a number of colleges for women alone, well endowed and equipped, largely attended and of excellent repute for scholarship. The American people may thus be said to have had a quarter-century's experience, upon a pretty wide scale, of these educational advantages. The length of that period has afforded opportunity for ascertaining whatever defects and limitations may have existed in this type of institution as first founded; and its close offers an appropriate occasion for inquiring whether important alterations require to be made, in the interest of the pupils especially concerned, or in the interest of the general community.

[1] Vassar College, founded in 1861; opened in 1865.—Ed.

Since the first colleges for women were founded, great changes, economic and social, peculiarly affecting the condition of women, have taken place in the life of our people. Do these changes require any considerable alteration in the general scheme of education for the young women of America—any alteration, that is, farther than would be involved in the natural development of that scheme according to its original idea, and in the general, gradual movement of college discipline and training for students of either sex indifferently? Changes have, indeed, been seen to be required, and some of them have been more or less rapidly effected in colleges for women and in colleges for men; but has any reason for change appeared which peculiarly affects the former class?

And, first, what was the scheme of education adopted in the several institutions of this kind which came into existence during the period in question? Speaking generally, it was nearly identical with that which had long been tried and approved in the education of young men. So far is this true that it has become a familiar claim, on the part of the more ambitious of the new colleges, that their curriculum is in all respects coextensive and equally difficult with that of men's colleges.

I shall not pause to inquire whether this object was in itself desirable; whether young women should be called upon to do in four years all that young men may be required to do in the same time; whether exceptional consideration be not due to the greater delicacy, sensitive-

ness, and liability to nervous derangement on the part of the female sex. I shall not even stop to ask whether this claim was ever, anywhere, made good except in the case of highly selected bodies of young women; or whether, through conscious or unconscious relaxations of the nominal requirements, the work exacted, in even the most advanced of the women's colleges, has not, in fact, mercifully fallen somewhat below a full equivalent of that done in the other class of institutions. I desire here only to note the fact of such a claim having been freely and widely made, as corroborating the statement that, in general, the scheme of education for women adopted twenty-five or twenty years ago, was substantially the same as had been approved for the training of young men.

One exception, indeed, requires to be taken to the assertion that the curriculum of the new institutions was meant to be, alike in substance and in form, identical with the traditional curriculum of the American college. This exception relates to the studies and exercises having reference to the preparation of the student for public speaking. But even this modification was in a direction already clearly indicated among the men's colleges themselves by the gradual decay and disuse of declamation and debate. This has steadily gone forward since that time, until now, in the most advanced of the older institutions, preparation for public speaking, and even for public writing, is given but little attention. So we may fairly say that, in the most important respect of

their original difference, the colleges for men have come to the colleges for women.

The changes which I have referred to as occurring peculiarly to affect the condition of women, within the period since these colleges were founded, are:

First, the greater call for women to interest themselves in public affairs; and

Secondly, the procrastination of marriage and the restriction of the marrying class, throwing upon women, in a degree before unknown, the necessity of independent self-support.

In speaking of the greater call for women to take part in public affairs, I have no reference to the current agitation for female suffrage. Altogether irrespective of this is the peremptory demand upon the educated members of that sex, in these later days, to concern themselves with matters once wholly managed by men. In addition to the rapidly growing freedom with which women are admitted to school boards and committees, and to a participation in the management of public institutions of charity and beneficence, one has only to look about him, in his own town or city, and see what the educated women of the community are doing; one has, indeed, only to peer (by permission, of course) into the engagement book of his wife, sister, or daughter, to get a somewhat startling view of the enlarged activity of the woman of to-day, making a demand upon her, if those duties are to be well performed, for more training and

an ampler equipment upon that side than was required, or was possible, a quarter of a century ago.

But this want has not been left thus long to be supplied. Men's colleges and women's colleges together have been applying themselves, during the whole of the period in question, to do that which will largely meet this need of the times. Not, indeed, that the colleges, professedly, or perhaps even consciously, have made any considerable changes in their curriclum in the interest of a better preparation of either women or men for public affairs. The changes in this direction have been made because the tendency in education, upon purely educational grounds, has, of recent years, set strongly and steadily towards those studies and exercises which peculiarly qualify the student for social and political duties.

The assertion that the changes in the curriculum of the American college which have so fortunately met the freshly developed want in education on woman's side, have not been due to such a purpose, or even to an unconscious recognition of the new need, may perhaps be questioned; but I believe it to be true. Even in men's colleges the rapid extension during the past twenty years,—one might almost say the first introduction within that period,—of history, economics, and statistics, has not come from the desire on the part of teachers and administrators to fit their pupils better for public duties. It has taken place because history, economics, and statistics had, in the course of educational development, become

studies which would crowd themselves into the colleges, whether or no; which could no longer be kept out; which made an imperative demand for room in every institution devoted to the liberal arts. Before that time those studies, as known in the United States, had not their developed methods—had not their qualified teachers. Those methods were not developed, those teachers were not trained, to fit either American women or American men for the social and political life of their country. In fact, those methods were not developed, those teachers were not trained, here in America at all. It was abroad, in Germany, where those studies were pursued as a necessary part of a great and comprehensive scheme of intellectual cultivation, that this was done.

History, economics, and statistics become college studies in America, not because the want of them was consciously felt more than at any previous time in our history, not at all because the need of them had then first specially appeared in the education of women, but because those studies had, under altogether other and foreign impulses, assumed an educational character which made it impossible to keep them out of any institution assuming to offer a liberal training, and because a host of young Americans, taught in the universities of Germany, were returning to their native land as the missionaries of the new cult.

But whether we adopt or reject this view of the cause of the rapid rise and growth of the historical and political sciences in our institutions of learning generally, it

certainly cannot be claimed that the result was in any degree due to the newly developed want of women's colleges. Nevertheless, that want, thus suddenly occurring, has been most fortunately supplied. Although history, economics, and statistics first came into America through the colleges for men, they rapidly made their way into the women's colleges, so that now, in the most advanced of these, the new studies are cultivated almost as assiduously as in the institutions for the other sex; and the catalogues of women's colleges show an increasing disposition towards the further recognition of the historical and political sciences as instruments of liberal culture.

I think we may conclude, then, that the change upon what we may call the political side, in the condition of American women, does not call for any important alteration of the curriculum, other than has been involved, to use my own phrase, "in the natural development of the scheme according to its original idea, or in the general gradual development of college discipline and training for the students of either sex indifferently." The required modification has, in fact, already taken place, not at all with reference to the special needs of American women, but under the general educational impulse of the age.

It is a more serious and difficult question, whether the other change which has been indicated as affecting the condition of women, through the procrastination of marriage and the restriction of the marrying class, especially

among the educated and cultivated portion of the community, throwing upon women, in a degree never before known, the necessity of independent self-support, does not call for extensive modifications of the curriculum as established when these colleges were instituted. The reasonable expectations, the usual prospects for life with which young women went to college when that opportunity was first offered them, were widely different from what they now are. Not only is the time of marriage long procrastinated, not only is the proportion of celibates increasing throughout the total population, but among the educated and cultivated classes these tendencies are felt with a force which is rapidly changing our social ideas in many particulars, and is fast bringing in new economic conditions.

Here again, however, a modification of the college curriculum, under the general educational influence of the age, and not at all for the purpose of meeting the newly developed need in woman's training, has actually, to a considerable extent, taken place. Chemistry and physics have become important studies at the leading colleges for men during the past ten or fifteen years, not because it was expected that the students would use these sciences professionally, but because these sciences had assumed an importance, educationally, which would not allow them to be longer kept out, or, if admitted, to be confined to the petty proportions of thirty years ago. For the same reason, and no other, chemistry and physics have extended themselves rapidly to women's

colleges, and are every year asserting themselves more and more in the curriculum. Here again we have a development of women's colleges which was eminently opportune, although it took place without reference to the changes in the condition of women which made such a modification of the traditional courses peculiarly conducive to the training of women for independent maintenance.

The question I have now to ask is: Whether any change not in the nature of a development of the original scheme of women's colleges and not shared by the colleges for men, requires to be brought about, in view of the increasing need which women have, in these days, for self-support. The subject is one regarding which something might doubtless be said upon both sides; yet for myself I strongly hold to the opinion that, with a single important exception to be hereafter noted, those who are charged with the administration of the higher institutions of learning for women should continue to interest themselves solely in the question: What studies and exercises will conduce most to sound mental discipline, to general culture, and to the acquisition of a considerable body of correct information upon subjects of political, social, and domestic importance? not troubling themselves at all to give their pupils industrial arts, or to prepare them in any way specially and technically to enter "the market for labor." I heartily believe that, with the single possible exception to be noted, the studies and exercises prescribed for young women,

in their college courses, should be purely educational; and that, at least, the time has not yet come when the conductors of these institutions are called upon to ask what studies and exercises will best fit young women for any special line of remunerative work.

My reasons for believing that the colleges for women should, at least in the present and the immediate future, confine themselves to the proper college function of mental discipline and mental development, are as follows:

First: Because the presumption is still happily in favor of the ultimate devotion of woman's powers and faculties to domestic life and duties, in which general training will count for much, and special training for but little.

Secondly: Because the occupations of a business character which are as yet freely opened to that sex are generally those in which woman's tact, dexterity, and quickness of apprehension will enable her most readily to dispense with previous special or technical preparation, and in which, consequently, general training will tell to the utmost.

Thirdly: For the comparatively few women who have a strong "call" to technical professions of a severely scientific character, opportunities are already provided at several institutions of high grade which admit the members of both sexes, without discrimination.

Fourthly: For certain of the higher professions, if I may venture to call them so, in which women take a part

equal, if not superior, to that taken by men, opportunities for training are now afforded in special schools, which exist in great number and in great variety, often fully equipped and well administered. To students, for example, of music, drawing, painting, and, under my breath be it spoken, of the drama, this country presents advantages as great as could reasonably be expected in a civilization as new as ours. If more is to be looked for, it must be through the progressive improvement of these special native schools or through foreign residence and study.

I now come to the one important exception, already several times intimated, which, in my opinion, requires to be made to the principle that the colleges for women should still remain, as they have been in the past, non-professional, wholly educational. That exception relates to the training of teachers. Already the leading colleges and universities for men are turning their attention to this urgent need of the times and are establishing chairs of pedagogy for the instruction of their undergraduates in the theory and history of teaching. I believe that the colleges for women should go still further in this direction, so that each one of them shall become, in a high sense, a normal school.

The profession of the teacher is not only of vital importance to the community, it is that one of all the larger professions which is mainly relinquished, by general consent, to women. To fill the vacancies in the ranks of the teaching profession, occasioned by all causes, and

to supply the additional assistants required by the growth of the country, at least twenty thousand young women should each year present themselves as qualified to undertake these onerous and responsible duties. To meet this tremendous demand, the so-called normal schools are striving with the best of their powers; but they cannot do all that is required, while much that they do is less than well done. Held down, as they are, by the presence of large numbers of pupils who are not even graduates of high schools and obliged to devote no small part of the time and strength of their staff to elementary instruction, not in the teaching art, but in the subject-matter of what is to be taught, these schools cannot do themselves or their better pupils justice; and many of those whom they graduate are accepted by school boards only because the supply is so painfully inadequate. The number of teachers actively demanded for giving instruction in the higher branches of learning in the secondary schools of the country, and for bringing inspiration into the more fortunately circumstanced grammar schools, would take up every year more than all the graduates of all our women's colleges.

I offer, then, this plea for normal instruction and training in all colleges for women. The need of the country is so urgent that some sacrifice of the strictly educational character of these institutions might properly be submitted to, were that necessary, in order to secure a higher professional result in a department of public service so peculiarly woman's own and so vitally

important to the welfare of the people. But, in fact, I do not believe that the introduction of the studies and exercises proper to this object would impair—on the contrary, I believe it would greatly improve and highly exalt, the true educational work of these institutions.

I would not have the colleges for women teach the mere arts of the pedagogue, or undertake to anticipate the necessary work of experience. But I would have the history and the philosophy of education made prime subjects of study. I would have the psychology of teaching taught. I would have the mind, in its powers of perception, observation, reflection, and expression studied as objectively and as scientifically as specimens in natural history are studied in the classroom and the laboratory. The order of development of the human faculties, the child's way of observing, the child's way of thinking when untaught and untrained, the ways in which the child may be interested and drawn out of himself—these should be the matter of eager, interested investigation. Surely, they are as well worthy to be the subjects of study as are the processes of vegetable or animal growth, as the order in which the leaves are set upon the stem, or as the mechanism of the human body.

The art of the teacher, the art of simple exposition and familiar illustration, the art of putting questions and stimulating thought—this art should be both studied and practiced, practiced and studied, year by year. I would have the pupils frequently called to assume, for a brief space, the responsibilities of instruc-

tion. I would have classes formed to investigate problems in education, starting questions, stating propositions, adducing facts, discussing principles, consulting authorities, answering objections, under the guidance of teachers who shall have their own minds directed upon the end of training their scholars not merely to communicate thought, but to create it.

Does it seem that the dedication to such uses of a portion of the time at the command of the faculty would, in the result, interfere with the educational character of the curriculum? Would not the remainder of the four years' course be worth, even for mere acquisition alone, as much as the whole formerly was? I surely think so. I believe that what has been suggested is the very thing most needed to give its best effect to the studies in classics, philosophy, mathematics, natural science, history, and politics, which make up the traditional courses of our colleges.

That such a training would fit the graduates of women's colleges to take up the work of the teacher with great advantage, no one will question. They might at first be found to be, in mere smartness, glibness, self-confidence, and ease of bearing, behind the graduates of the typical normal school; but their broader scholarship and higher culture would qualify them, in a far greater degree, to reap the fruits of experience, and they could not fail, after a brief period of apprenticeship, to take their place among the most useful members of the profession.

But what of those who are destined not to enter the ranks of that profession, but are to find their life's work at home, in the domestic circle? Need the question be asked? Could any nobler preparation for the duties of wife and mother be devised than that which I have thus outlined? Surely, this part of the college training would never run to waste. The Latin and Greek might be unused and soon forgotten; but the hearts and minds of the next generation would be inexpressibly benefited by the gracious fruits of studies and exercises such as these.

THE SECONDARY SCHOOLS AND HIGHER EDUCATION

1894

A Discussion of the Question: How May Closer Articulation between the Secondary Schools and Higher Institutions be Secured? at the Ninth Annual Meeting of the New England Association of Colleges and Preparatory Schools, October 12, 1894. From the *School Review*, December, 1894.

THE SECONDARY SCHOOLS AND HIGHER EDUCATION.

ANY part I may take in the deliberations of this meeting ought to be a grateful one—grateful to me, because, as a representative of scientific and technical schools, I have only to give assent to the fundamental propositions of Dr. Huling;[1] grateful to you, because my simple contribution will not long detain you.

So far as I am aware, there can be no occasion for the scientific and technical schools of this country to object to any of Dr. Huling's proposals. Inasmuch as those schools to-day require no more than is provided for in at least one of the courses offered by the Committee of Ten,[2] they can possibly have no adverse interest. The report does not call upon us to make any concessions whatsoever. Any scientific school in the land would be quite content to have its students bring with them as much as is embraced in the course to which I refer. Therefore, so far as I am to speak for the scientific and technical schools, there can be no reason for doubt or hesitation in giving support to the propositions of the Committee. Indeed, so far as my constituency

[1] The question under discussion had been presented by Dr. Ray Greene Huling, of Cambridge, Massachusetts.—ED.

[2] In its valuable report (1893) to the National Educational Association.—ED.

is concerned, the changes proposed by the Committee would be all clear gain.

This completes all I have to offer as a representative of scientific and technical schools; but, if I might venture to refer for a moment to the position of the classical colleges, I must confess that I have a great deal of sympathy with that view of the English high school which is presented in the extract quoted by Dr. Huling. I believe in the free development of the high school in this country, without constraint from the outside, and without any concession to either the colleges or the technical schools. I believe that the high schools should not be asked to do anything more than what would be for their own best development as schools a great majority of whose pupils are to go directly out into practical life without further advantages of education. I believe that the English high schools were created for the benefit of pupils of this class; and that they should go steadily forward upon that line, simply asking how they can best serve the needs of this portion of the community, making no surrender and no concessions to the wishes or the interests of the colleges, on the one hand, or of the scientific and technical schools on the other. The colleges have, and for a long time have had, complete control of the endowed academies and the public Latin schools. If the colleges want any more than this for their own purposes, let them provide it. If, again, the scientific schools need any more or any different preparation from that which the high schools would

give, from their own point of view and for their own proper purposes, then let the scientific and technical schools provide it for themselves. The English high school has its own definite, important work to do in the American system of education, which is to give the best possible courses of instruction to young people, between fourteen or fifteen and eighteen or nineteen years of age, who are not able to carry their studies on into the college or into the scientific or technical school. This is the proper work of the English high schools; and those who are charged with the conduct of such schools should allow nothing to divert them from that object. If the instruction given by the English high school, according to its own point of view, with reference to its own purposes, does not precisely fit its graduates for the classical college, then I say the college must come to the high school, and not the high school to the college. The desired adjustment must come through concession from the colleges, and not by surrender on the part of high schools.

The foregoing remarks might seem from their tone to be antagonistic to the report of the Committee of Ten and to the propositions of Dr. Huling; but, in fact, they are not so intended. The colleges are now doing just this very thing. They are coming to the English high school, and they are coming fast, climbing over the fences and breaking through the hedges to get as quickly as possible upon the ground of an education which omits the once universal requirement of Latin and Greek for

all college students and through practically the whole college course. The surrender has been on the part of the colleges and not on the part of the high schools; and in the readjustments which will properly follow that surrender the needs and the capabilities of high schools should be kept carefully in mind, rather than the needs and the convenience of the colleges.

Having long and strongly held this view of the mission of the English high school in our educational economy, I would not have those who control these schools give up one jot or tittle of what is for the good of the high schools themselves, according to their original idea, or divert in any degree the instruction given in such schools from the direction which will best serve those who are to end their school life at that point. But it does not seem to me that the report of the Committee of Ten and the suggestions and propositions of Dr. Huling ask anything of the high schools other than is for their own good, according to their original purposes. On the contrary, it appears to me that the programmes of the Committee of Ten are such that they might have been drawn up solely for the good of the English high schools themselves, and not at all with reference to the needs of colleges and scientific schools. I would not say that, in the point of the amount of work required, those programmes may not transcend the present capabilities of the less favored schools; but, subject to this caution, I think that the most ardent supporter of the traditional English high school may cheerfully and cordially accept

those programmes as of the nature of an enlargement and improvement of the high school, in its own interest alone.

Referring for a moment to the question of admission to colleges and scientific schools by certificate, which was brought up by Dr. Huling, I would say that, in my judgment, the general movement in this direction is a fortunate one, and is likely to be carried still further to the advantage both of the college or scientific school and of the preparatory school, whether endowed academy, Latin school, or English high school. But it does not seem to me that there should be any effort to force this matter. The result will be better accomplished in the end if it is brought about gradually, and, indeed, by piecemeal, here a little and there a little, each individual college or scientific school proceeding by negotiation with its own special "feeders" and shaping its course according to its own particular needs. Indeed, it is doubtful whether the system of admission by certificate will ever be made universal. It is safe to say that *some* colleges can admit students by certificate from *some* preparatory schools. It is perhaps safe to say that *some* colleges could safely admit by certificate from *all* preparatory schools. It is possible that *all* colleges might admit by certificate from *some* preparatory schools. But to say that *all* preparatory colleges could admit students by certificate from *all* preparatory schools, is going a great deal further than the results of experience justify.

Regarding the complaints, cited by Dr. Huling, which

impeach the results of examinations for admission to college, I would like to say a word.

It seems to me that an altogether false idea obtains respecting the proper significance and effect of these examinations. It appears to be a common notion that the successful passing of entrance examinations not only vests in an applicant the right to enter the school or college, but also the right not to have any other applicant, who has not passed the examinations, admitted. Hence, we have anonymous examinations, the candidates being known only by numbers assigned to them individually, with a hard-and-fast rule that those who pass the examinations with a certain degree of success shall be permitted to enter, and that all who fall short of that point shall be rejected.

It seems to me that this view of the significance and effect of examinations is altogether wrong. The prime object of holding entrance examinations is to save young men from beginning courses in which they would probably fail through lack of preparation. The examination is primarily and principally, not for the sake of the school or college, but for the sake of the applicant; that he may not suffer disappointment; that he may not lose his time and money in a futile attempt to carry on courses which are beyond his ability. A school or college, on its part, would suffer no particular harm by having a certain number of ill-prepared students enter its first class. It is the students themselves who would suffer; and it is for their sake that entrance examinations

are held. From this point of view, the examinations become merely a sieve which rapidly and confidently separates the body of applicants into two general classes: those who are manifestly well prepared, and those who probably are not prepared. But no reason exists why there should not be further inquiry and careful consideration regarding any person who has failed in the formal examination, especially one who has passed the usual age of admission, as to whether he may not, in spite of that, be fairly qualified to begin the studies of the school or college. Regarding the great majority of those who fail at formal examinations for admission, there is, of course, little to be said; the one thing they need is to go back to preparatory schools and to do their work, or certain portions of it, over again. Among those rejected on first trial, however, often are found men whose partial failure is due to causes easily explained. Justice, not less than kindness, requires that such persons should not be compelled to lose a year of life, perhaps practically be debarred from a further educational career. Certainly, to say that an applicant who has been admitted has a right to object to the admission of others, is to give the examinations a significance and an effect which are unreasonable. In the school with which I am connected, I think there has been no year for a long time in which the faculty have not, after carefully considering the cases of rejected men, where there appeared to be reason to believe that the examinations had not proved

a fair or a conclusive test, admitted one or more such persons. They have never felt themselves precluded from dealing with any case upon its own merits. If it were found that an applicant, by reason of temperament, was always at a disadvantage in examinations; that his preparatory school record showed that he did better in current daily work than upon review or parade; and especially, if he bore a character for fidelity, industry, and persistency, he might be admitted in the face of examination marks below the standard. In other words, if I may use a technical expression, we have always at the Institute of Technology felt entirely at liberty, so far as examinations are concerned, to "work over the tailings," and to extract and save any valuable metal we might find there.

A VALEDICTORY

Addressed to the Class of 1887, Massachusetts Institute of Technology, upon their Graduation, May 31, 1887.

A VALEDICTORY.

It is now my pleasant duty, on behalf of the Corporation and Faculty of the Massachusetts Institute of Technology, to present to you the diplomas of your honorable graduation, and to greet you Bachelors of Science.

What we have said in these testimonials we truly and fully mean. All that is here written is to be taken without discount, qualification, forced construction, or academic fiction. These diplomas testify to four years of hard, patient, self-denying, persistent study and practice, week by week, month after month, in science and in the application of scientific principles to the arts of life. All this is precisely true in the case of each and every one of you.

And on behalf of your teachers, I gladly bear witness to the cheerfulness, courage, and zeal with which you have met the exacting requirements of our curriculum; the fidelity and high sense of honor and duty with which you have borne yourselves through these trying years of laborious study. Those qualities have won the respect and affection of your instructors here; they cannot fail to secure recognition and to command confidence in the new lives on which you are entering to-day.

Fortunate are they who, in opening a new chapter of life, are not required to do what is implied in that omi-

nous phrase, "turning over a new leaf." You are not now called upon to close a career of dissipation, or idleness, or frivolity, or triviality, with good resolutions of amendment and reformation for the future. Your friends and teachers are not counting the chances that the closer contemplation of life's responsibilities, or perhaps the actual pressure of its burdens, will sober your minds, give you a serious sense of duty, and inspire you for the first time with a strong and controlling purpose. All this has already been done in your case: else you would not now be here.

I would not speak to you as if your characters were altogether formed, your education completed, or the last of the perils that beset life happily passed. Much, very much, remains; but it is not by turning around in your course, it is by following on as you have so well begun, that you are to pursue your voyage and reach the haven of your hopes and rightful ambitions.

It is always a long and weary way which involves the retracing of steps that have gone in the wrong direction, or the making up of time that has been wasted; and I cannot sufficiently congratulate you that you have taken the morning of life, while the heart is buoyant within, the limbs stout and active, while the air around is fresh and fragrant, and the sun is yet low in the heavens, to make so strong and stalwart a beginning of your journey. I cannot believe that, as you pause on this eminence, here on your graduation day, and look back and down upon the camps of those who have not yet girded them-

selves for the march, but are still resting in the comfortable belief that it will do as well to begin life in earnest at twenty-one or twenty-five, you are at all disposed to regret your own early start and the manful exertions to which you have given the dewy hours of morning.

My friends, the point toward which all your studies and exercises have been directed these long years is at length reached; the hour has come for you to say good-by to each other and to your teachers, and with brave and hopeful hearts to step over the threshold of the school out into the wide world of action.

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